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WELCOMING THE NEW CENTURY.

The Municipal Assembly of Greater New York is getting ready for a Twentieth Century celebration. President Guggenheimer in his reviewing resolutions as to the work of the dying century, named six triumphs of discovery and invention. Four of them are electrical, and he would have us believe that more and nobler are to come. Part of the celebration consists in decorating the City Hall with electric lights. Evidently electricity is recognized to the full value of its deserts, and we hope the plan may go through, in spite of the frank protest of one member that "there is nothing in it for the Aldermen."

THE VERSATILE TELEPHONE.

One of our steam contemporaries calls attention to the fact that an American manufacturer of rotary pumps advertises as follows: "Our pumps at work about three miles out in the country, are started and stopped from the company's city office, their operation being ascertained by telephone. This goes on for days without any person going near them." There could, of course, be other electrical methods of observing the fact that the motors and pumps were at work, but the audible indication of the telephone is all right.

There seems to be no end to the duties that can be thrown on the telephone, and each latest suggests a new one. For example, in mill towns, it is now found that calling people up in the morning by telephone beats the alarm clock and the perambulating watchman all hollow. This idea has recently received an extension in a Western city where a patient, tired of depending on careless nurses, now has them notified by telephone every time the hour comes around for the administration of his dose. It is said the plan works to perfection.

POWER FACTOR INDICATORS.

The power factor of an alternating-current system or combination of conductors is often of much practical importance to the electrical engineer and station manager. It is a quantity that is readily apprehended, easily defined, and is entirely independent of hpyothesis as to the shape of the waves of alternating current or pressure. In other words, "the cosine of the angle of lag" assumes that there exists a veritable angle, and this assumes sinusoidal electromotive forces and currents. In an actual circuit, there may be no such arcadian simplicity, and the best that can be said in such a case is that there exists certain ideal equivalent sine waves representing the real more complex waves in regard to power and amplitude. A power factor is, however, only a coefficient which converts the volt-amperes of a circuit into watts, and this makes no supposition or postulation in regard to the wave forms of alternation.

The power factor of an alternating-current system is of much practical importance in regard to the regulation of pressure. A large power factor—approaching 100 per cent—is usually accompanied by good regulation of the dynamos and transformers. A small power factor is apt to be accompanied by bad regulation. The power factor of induction motors is of much importance from this point of view. The power factor has usually to be obtained by measuring the volt-amperes and then the watts, and finally dividing the former into the latter. An indicator can be devised to do this automatically, and Mr. Aug. J. Bowie, in an article which appeared in these columns several months ago, described such an arrangement, consisting of a differential electro-dynamometer in which the movable system assumes a certan resultant angular position in obedience to two opposing couples. The same current enters as a component into both couples and the remaining components are two definitely dephased voltages,

one for each couple. For some laboratory work and central station use, an instrument of this character would be convenient, mainly as a time-saver in dispensing with the work of determining power factors from isolated observations.

THE MAGNETIC QUALITIES OF IRON AND STEEL.

There can be no doubt that the commercial success of electricity in the transmission of power is due to the magnetic properties of iron and steel. If iron did not posses this most wonderful property of developing a structural m. m. f. when subjected to the influence of a magnetic field, and thereby greatly exalting the magnetic flux initially developed by the exciting current, the electric dynamos and electric motors would still be the interesting toys that they were in the thirties. It has long been recognized as of the highest importance to select iron that had the lowest reluctivity, or developed the maximum flux density when subjected to a given working magnetizing force. The result has been that electrical industries have developed special magnetic irons and soft steels of low hysteretic and reluctivity coefficients. At the same time, permanent magnet steels have been produced with large coercive forces and hysteretic coefficients.

The observations collected by Messrs. Esterline and Treat, appearing in this week's issue, are interesting as showing the comparative magnetic behavior of irons and steels taken from a number of electrical manufacturers. In cast iron, the mean density is 3460 gausses at 10 gilberts per centimetre, and 9200 gausses at 100 gilberts per centimetre. Retaining the same magnetizing forces, the mean densities in wrought iron are 12.94 and 17.27 kilo-gausses. In the laminated metal the mean densities are nearly the same, viz., 12.5 and 16.9 kilo-gausses. The widest variations seem to be found among the cast steels, and indeed the opportunity for the admixture of impurity with the iron is present in the process of steel casting to an inviting but dangerous extent.

APPLICATION OF ELECTRIC HEAT.

In another column we print an article on the application of the electric furnace to laboratory purposes, which furnishes another illustration of two valuable properties of electric heating—the exact manner in which it may be controlled and localized. As pointed out by Prof. Norton, the controlling of temperature conditions through the use of electric heating devices opens up a great field of temperature research. Temperatures as high as 1250 C. were employed, and no difficulty has been found in holding the furnace at any desired temperature up to this point with a precision within the smallest reading of the usual pyrometer scale. The range of employment of this type of furnace in physical research appears to be very extensive aside from its value in calibrating high-range temperature indicators, as is indicated by work described in the article.

From the utilitarian standpoint a still more important field for electric heating is in industrial operations where a localized and constant temperature of moderate degree is required. Aside from culinary purposes the only portion of this field that has been exploited to any considerable extent is that having relation to hat-making processes. In this case, the best results demand a constant temperature and localized heating, and notwithstanding the very high intrinsic cost of electrical heat, its use for this purpose has been found to be economical. The economy has followed from the fact that as the heat is generated only at that surface of the heating device which is usefully employed, but a fraction of the total heat expended in the old process is necessary; while the absence of the discomfort, so distressing in warm weather, incident to the utensils displaced, has resulted in a greater output for the same amount of labor, and also in a better quality of product.

It is, of course, in electro-chemical operations that the heating property of the electric current has had by far the most important application. Owing to most electro-chemical processes being carefully guarded from the public, the literature on the industrial side of this branch has been so limited and so meagre in details, that its development has attracted less attention than any other branch of electrical application. The present extent of this application may be surmised when it is considered that the greater portion of the electrical energy generated at Niagara is utilized in electric furnaces; and the future of this branch, as partially indicated by the recent Massena development, promises to make it one of the most important of electrical applications.

GROUNDING THE NEUTRAL POINT OF LOW-TENSION SYSTEMS.

The Underwriters' National Electric Association, at its recent meeting in New York, adopted an important modification in the "National Electric Code" or rules of the National Board of Fire Underwriters. The substance of the new rule is that low-tension circuits may be grounded at their neutral point or points. Thus the middle point of the low-tension secondary winding of a step-down transformer may be permanently grounded, and the neutral main conductor of low-tension, three-wire system may be grounded. This is, we consider, a good and wise provision. The permanent grounding of transformer secondaries, if effectively carried out, is an absolute safeguard to personal injury from accidental crosses between primary and secondary circuits, accompanied by personal contact with the secondary circuit.

It is probably an increased security from danger to fire by reason of accidental crosses between primary and secondary circuits, since such a cross in the case of a grounded secondary would probably result in a current to ground from the primary circuit, or sufficient strength to blow the primary fuses, and so disconnect the defective transformer. In the absence of such grounding, the cross between primary and secondary circuits might produce a long-continued leakage current through the secondary wiring capable, under certain conditions, of setting fire to inflammable material. Moreover, the permanent connection of a neutral point to the ground makes no change in the normal electrical condition of the circuit so grounded, since a neutral point is already at the potential of the earth. If, moreover, such a grounded connection is imperfectly effected the protection afforded may be imperfect in corresponding measure, but the grounded system will not be more dangerous, but rather safer for the imperfect ground.

As regards three-wire, low-tension systems, either direct-current or alternating-current, it will be a great advantage in most cases to have the neutral point grounded permanently. It is seldom that such a system is free from all liability to contact with neighboring high-pressure systems, either in defective transformers in buildings, or on poles. Any extensive three-wire system has a large current-carrying capacity from either outside main through the lamps or motors to the neutral, and the risk of accident to person or property is less in the case of a cross when the neutral is permanently grounded than when the system is supposed to be insulated.

A large low-tension system never can be really insulated in the same sense that a piece of rubber-covered wire is insulated, so that an undue pressure suddenly brought to bear upon the system is likely to produce dangerously strong leaks to ground in a number of places, perhaps where least expected, and where serious results may follow To trust to apparent insulation and ignore the dangers of an acciden-

tal high-pressure cross is to depend upon a theory and neglect conditions. A small Edison three-wire system as, for example, within the limits of a single large building, may be safely operated without grounded neutral, but a large Edison system ought, for its own protection, to have the neutral grounded. This is particularly the case when the Edison system is supplied from a high-pressure alternating-current system through the intermediary of alternating-current transformers and converters. It should not be possible for any failure or defect in the transformers or converters to suddenly subject the system to a high electric pressure, as might be the case in the absence of the permanent neutral ground.

No provision appears to be made, and no ruling adopted, for grounding a two-wire low-tension system, such as the ordinary single secondary circuit of a step-down transformer. In other words, if the secondary winding of the transformer does not have a middle point brought out, the rules as amended will not allow of connecting the secondary circuit directly and permanently to ground.

HIGH VOLTAGE THREE-WIRE SYSTEMS.

Another good amendment adopted by the Underwriters' National Electric Association is the raising of the limit of low-pressure systems from 300 to 550 volts. Hitherto any system in which the dynamo supplied a pressure exceeding 300 volts, was treated in the rules as a high-potential system, and the wiring in connection with the same had to be open wiring in plain sight, as distinguished from being covered in wooden moulding, or by concealed work. The new rule permits the use of 500-volt systems other than trolley systems to be used in buildings with suitable restrictions as to wiring and fittings. Moreover, an increase of pressure in a plant from 220 to 440 volts by the replacing of 110-volt lamps by 220-volt lamps in the three-wire system is permitted, but only after overhauling and inspection. There are already quite a number of three-wire 440-volt direct-current lighting systems, and their number seems to be on the increase. The Underwriters' National Electric Association has, therefore, done well in considering the matter at this stage, and in insisting upon proper safeguards for the doubled pressure, instead of persistently ignoring the existence of such systems, and then attempting to modify the wiring of such plants some years after their installation. It may be added that the grounding of the neutral in such 440-volt three-wire systems will enable the maximum pressure, brought upon the wiring, to be reduced to 220 volts.

But the Underwriters' may very properly ask the engineer what he proposes to do about it, now that the way is open. To tell the truth, it is not easy to determine the status of low-tension distribution at 250 volts from lead to neutral. Such practice is increasingly common abroad, and is followed in occasional plants here, but whether it fills a long-felt want, or is merely a make-shift, is no easy matter to determine. It is perfectly well known that the exigencies of growth have long since driven the ordinary low-tension systems to dire extremities in the way of drop in the feeders, and that in storage battery sub-stations or in transmission by polyphase currents to rotary converters, neither of these resorts has the merit of high efficiency; but no one has as yet been able to make up his mind to the extreme measure of going squarely over to polyphase distribution even for new work. Can the new low-tension distribution afford a refuge—present a means of preserving the rapidly disappearing system of the past?

In the first place, it must be remembered that in large urban systems the whole mechanism of generators, distributing conductors and services is adapted and admirably adapted to the moderate pressures now in use. The lamps are efficient and durable and the customers are given good service. As a rule, the systems would require extensive and costly reconstruction if the working pressure were to be doubled, both inside the station and out, and such would also be the case if alternating currents were to be used. Hence there is good reason for conservatism, and if feeders and batteries are inefficient they are chiefly so during the comparatively brief period of heavy load. Even if it would pay to make the changes necessary to double the working pressure there would still be the difficulty of lessened efficiency of the lamps. In the present state of the art a 250-volt lamp requires roughly one-third more energy per candle-power than a 120-volt lamp of the same candle-power and expectation of life. With metered service this loss would apparently fall on the customer, but the increased bills would inevitably raise such a storm about the ears of the lighting companies that they would have to shoulder part of the burden in the form of rebates or the more frequent renewals that would result from using 250-volt lamps of the higher efficiency. In any event, there would be practically a transfer of the present loss in feeders and mains to loss of some sort in the lamps, so that the apparent gain would be materially diminished. Of course, there is a good chance that the high-voltage lamps may be materially improved in efficiency, but in such case one would naturally expect corresponding improvement in lower-voltage lamps which would offset the gain. On the whole, therefore, it does not seem likely that the high-voltage lamp will take a strong hold upon the central stations for the present.

On the other hand, for large isolated plants there is considerable to be said for the practice. In such cases it seems to give a very economical distribution, even in spite of the lower usual efficiency of the lamps. For in many isolated plants it is a perfectly easy matter to lay out the installation for lamps of 24 or 32 candle-power, which can be made of good efficiency, even for the higher voltages. Very large buildings, and institutions comprising groups of buildings more or less scattered, may find a high-pressure three-wire system economical and convenient. For the same reason small cities and large towns may sometimes find a change in voltage useful. Here, however, one has usually to contend with poor interior wiring which is none too safe, even at the present voltages, and if the station has to be renovated for the new system it will generally be advantageous to go the whole way and put in modern alternating apparatus. But still there are instances in which a 500-volt three-wire system would be the best way out of a bad tangle. It is certainly better than the alternating system as at present found in too many instances, with single-phase high-frequency apparatus and house-to-house transformer distribution. One sometimes finds in a city of moderate population and extent a really excellent three-wire disrtibution, well planned and kept up, with no great increase of territory to cover, where the double voltage could be used with capital results. But on the whole, the outlook is such that the underwriters are likely to have time for comfortable contemplation before practice catches up with their precepts.

Possibly one aspect of an extension of direct current work in any direction whatever calls for serious thought, and at the risk of being ultra cautious we may here suggest it. It is a fact that nearly all the directions in which work is progressing toward an electric lamp of revolutionary character—the light of the twentieth century—lead away from direct currents. When such is the outlook, the wisdom of undertaking any elaborate reconstruction of existing plants with a view to greatly increasing a direct-current distribution is at least a proper subject for debate. It is a time to make haste rather slowly and to watch the trend of the art with unremitting vigilance.

The New York Electrical Society.

The 210th meeting of the New York Electrical Society was held on Dec. 12. Dr. Samuel Sheldon, Professor of Electrical Engineering at the Brooklyn Polytechnic Institute, lectured on "Electrical Measurements of Precision." In opening his lecture Dr. Sheldon said that nearly all the measurements carried out in the practice of the electrical engineering profession are made with an accuracy which entitles them to the name of measurements of precision. However, they permit of classification into two groups, viz., commercial measurements and measurements of precision. Commercial measurements are made with only such a degree of accuracy as is required by commercial conditions, while every posible refinement is employed in the making of measurements of precision. Commercial determinations, e. g., of hysteretic constants, of $\mathfrak{B}$-$\mathfrak{H}$ curves, of dielectric strength, and of insulation resistance permit of errors of 10 per cent, of 2 per cent, of 20 per cent and of 25 per cent respectively. Comparisons of standard resistances, of standard cells, of standard current and e. m. f. meters must be made with the greatest possible accuracy, errors greater than 1-100 per cent being often unacceptable.

Of the measurements of precision which occur in practice nearly all are comparisons with standards and not absolute measurements which depend ultimately upon the standards of length, mass and time.

The use of the tangent galvanometer, which was so common a few years ago, has now almost entirely ceased. The instrument itself was burdened with a multitude of correction factors—many of them being of uncertain magnitude. The use of the instrument demanded a knowledge of the instantaneous value of the horizontal component of the earth's magnetism. This quantity varies in magnitude and direction in an uncertain manner. Vagabond trolley and lighting currents combined with the frequent use of structural steel assist in the uncertainty.

The standard cell, on the other hand, has come into scientific favor. The Clark cell, although officially standard, has a high temperature coefficient, and, under rising temperature, has a time lag due to the slowness of the processes of diffusion and solution. The Carhart cell is convenient to use, and has but half as great a temperature coefficient. Variation of the concentration of its solution, due to evaporation resulting from an imperfect seal or to a local action on its zinc, should be guarded against. The cadmium cell is of almost negligible temperature coefficient, but has an uncertain e. m. f. for temperatures below, say, 12 degs. C.

The best of modern standard resistances are made of manganin, which besides having a very small temperature coefficient gives very small thermal e. m. fs in combination with copper. Nearly all the alloys of nickel and iron have small temperature coefficients, but give large thermal e. m. f.'s with copper.

The galvanometers used in measurements of precision are either of the Thomson or of the d'Arsonval type. The former can be made to deflect 1 mm. at a meter's scale distance for an impressed potential difference of 1-100 of a microvolt. The best of the latter require one microvolt. The former are trying to the patience of the observer and are prodigal in the use of his time. The d'Arsonval could be made many times more sensitive, if a stronger field could be employed. Some existing types have a flux density of but 100 webers. The diamagnetism of the coil, however, prohibits the use of a very strong field. Perhaps aluminum wire would be less diamagnetic and would in addition furnish a lighter moving system.

The precise comparison of nearly equal resistances is accomplished by means of the Carey-Foster bridge-comparison between two standard resistances, one of which is nominally ten times the size of the other, but can be made by means of three nearly equal auxiliary resistances. They are wound upon the same metal spool, and each has a resistance approximately three times that of the smaller standard. The smaller standard is compared with the three in multiple; the three are compared with one another; then all of them in series are compared with the larger standard. The comparisons are made with the Carey-Foster bridge.

Another method makes use of an auxiliary box of five resistances having nominal values of 1, 1, 2, 3, and 4 times the resistance of the smaller standard. By means of the Carey-Foster bridge these resistances are compared with the smaller standard and with each other in combination. The larger standard is then compared with them in series.

Low resistance standards may be compared by means of the Thomson double bridge, provided the ratio of the resistances around the contact between the low resistances be adjusted simultaneously with the resistance in the main ratio arms. There may be a distortion of the flow lines in the low resistances. The method described by the lecturer in the *Electrical World*, March 5, 1898, is free from this objection.

All e. m. fs are best compared by means of some form of potentiometer.

Currents are measured by sending them through low resistances supplied with side potential terminals. The potential difference between these terminals is measured by means of the potentiometer.

After Dr. Sheldon's lecture, President Martin exhibited some 40 or 50 slides, chiefly night views, illustrative of lighting effects of the Paris Exposition. The day and night aspects of the same scenes were shown, and a great variety of details were given in regard to the manner in which the effects were secured. These Paris views were compared critically with a number relative to the same kind of work at Chicago, Atlanta and Omaha, and the different methods taken to obtain the same results were pointed out. It was shown that while in this country at large exhibitions there had been a remarkable advance in the use of the incandescent lamp outdoors, not merely for defining structures, but for general illumination, at Paris there had been a marked retrogression in the wholesale employment of gas. In fact, so far did the use of gas at Paris go, the Champ de Mars was full of it, and its lamps were carried right up to the very portals of Electricity Building. The two methods of lighting instead of harmonizing, clashed; and the effect was even worse when the colored electric fountains were playing. It was noted as to the fountains that, whereas at Chicago in 1893, arcs were employed burning in a horizontal plane, with revolving umbrella colored screens above them; at Paris vertical arcs were employed with inclined mirrors and with an apparent loss of intensity. The general absence of searchlights was commented upon. In regard to the illuminated front of Electricity Building, assuming the correctness of the principle that decorative lighting should be to a building at night what bunting is by day, Mr. Martin thought that the French were to be congratulated on securing that very effect so happily. Before the days of electric lighting, the lamps were fixed and practically unchanging in color. On this Paris building, the electric lamps were continually changing in color, grouping and effect, with slow and rapid movement, their own changes being supplemented by colored projectors from behind. The speaker thought that decorative lighting would be likely to develop along these lines.

During the meeting the subjoined resolutions were unanimously adopted:

WHEREAS, It is proposed to establish a national standardizing bureau, and

WHEREAS, Such a bureau would be of the greatest value and benefit to electrical science and industry in the United States, and assist in the further development of export electrical trade, be it

Resolved, That the New York Electrical Society hereby expresses its approval of the legislation in furtherance of such an object, and

Resolved, That the society associate itself with kindred bodies to secure the establishment of the bureau.

Messrs. Edwin Rust Douglas and Rumsay N. Scott were duly elected members of the society.

Power from Niagara River.

The proposed power canal from Niagara River to Lockport, which will cost at least $6,000,000, will be built. The committee of aldermen which has had under consideration the propositions of the Niagara. Lockport and Ontario Company, and the Lockport and Newfane Power Company, met last week and conferred with J. W. Ledoux, an expert engineer from Philadelphia, and Attorney King and S. Q. Mengle, representing the first named company, behind which is Vanderbilt capital. As a result of this conference the committee will report to the Common Council in favor of the Vanderbilt proposition. The Common Council will adopt the recommendation. The Vanderbilt proposal includes, besides the power canal, the construction of a conduit and pumping stations to supply Lockport with water from Lake Ontario, which is 12 miles distant. This triumph of the Vanderbilt company has been achieved in the face of strenuous opposition, it is said, on the part of Senator Ellsworth and the Hon. W. Caryl Ely, president of the International Traction Company, who are interested in the Lockport & Newfane Power Company, which has a big power plant in course of construction on Eighteen-Mile Creek, near Lockport.

Some Electric Furnaces for Laboratory Use.

BY CHARLES L. NORTON.

BELIEVING that the experiences of the past three years at the Rogers Laboratory of Physics, Massachusetts Institute of Technology, in the use of several small electric furnaces, for laboratory instruction and for research work as well, may prove of value to later experimenters, I am encouraged to give some of the details of construction and operation of them, with suggestions concerning their modification for other work.

Early in 1895 the difficulties of maintaining a sufficiently steady rate of heating for purposes of calibration of Le Chatelier pyrometers led us to make up a small muffle of fire clay which might be heated by means of a platinum wire wrapped around it and carrying a current of electricity. By the use of this little muffle we could expose

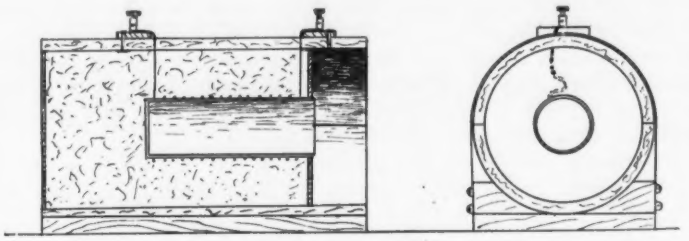


FIG. 1.—ELECTRIC FURNACE.

the junction to be calibrated to as gradual a rise in temperature as was desired. We next made several larger furnaces in exactly the same way, and found them of service up to about 1150 degs. C., and that their deterioration was not nearly so rapid as that of a gas muffle of the same size. Later we have made use of nickel wire and carbon powder to act as the conductor whose resistance causes the development of heat. The success of these furnaces for use below 1000 degs. C. is unquestionable, and in careful hands work may be carried on for a long time at 1250 C. without damage to the furnace.

All our earlier furnaces were made out of the ordinary cylindrical porous cups used in batteries. The cups are about 2 ins. in diameter and 5 ins. or 6 ins. deep. We wound around them spirally about 15 ft. of No. 28 B. & S. platinum wire, the spaces being from one-quarter to one-fifth of an inch between wires. The best method of keeping the wires from getting together and becoming short-circuited was to coat the cylinder after the wires were wound upon it with a thick paste of some non-conducting and refractory cement. It need not be at all strong—in fact, must not be, but merely to serve to keep the wires from falling together, without preventing a slight expansion and contraction. It is not necessary to cut or mould in the outside of the clay muffle, grooves or projection to keep the wires apart.

The main difficulty arises from the slagging of the platinum with the material in which it is imbedded. To wind the wire directly upon the clay is sure to cause slagging at 1100 deg. C. and a lining of asbestos is of very little help, if any. After long hunting we have found that the commercial carbonate of magnesia, such as is mixed with asbestos for use as a steam pipe cover, and some of the purest infusorial earths, from California and Nevada, are the most satisfactory materials in which to bed the platinum wire. The occasional overheating and melting off of the platinum wire is to be expected if the furnace is used by those unfamiliar with its operation, and it is, therefore, wisest to put it together in such a way that it can be readily rewound and replaced in its insulating packings.

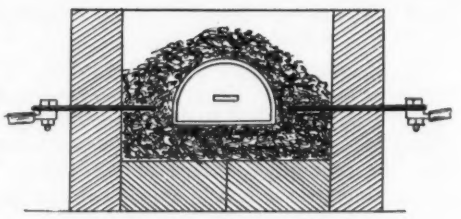


FIG. 2.—ELECTRIC FURNACE.

The detail of the construction used to accomplish this end is shown in the accompanying sketch, Fig. 1. The cylinder is first painted over with a coat of carbonate of magnesia mixed with water to about the consistency of cream. The wire should next be annealed, and then slightly crinkled by running it between a pair of loosely fitting gears. This renders breakage of the wire by shrinkage less frequent. The wire may very conveniently be wound upon the cylinder in an engine lathe, the cylinder being mounted upon a wooden plug. The next step is to coat the wired cylinder with a second layer of the carbonate of magnesia paste. The lead wires can to advantage be made of three strands of the wire which serves for the heating coil.

The form and amount of the insulating packing which is to be built up around the furnace depends largely upon the particular use to which the furnace is to be put, but, in general, some such packing as the following will be found satisfactory. Cut out of asbestos mill board a collar, or washer, just large enough to slip over the front end of the cylinder, and let its outside diameter be 5 ins. or 6 ins. greater. This collar and cylinder may then be slipped into a section of steam-pipe cover of any of the asbestos or magnesia varieties. A standard 8-in. or 10-in. cover makes a suitable casing for a muffle 2 ins. in diameter. The casing should be 6 ins. or 8 ins. longer than the muffle, to allow for packing at the back.

The amount of current required to keep these small furnaces at a bright heat is not far from 3 amperes at 220 volts. The cost of running the furnace is, therefore, only a few cents an hour.

A series of attempts at making muffles with a wire of nickel instead of platinum has shown that the slagging of the wire does not occur so readily as with platinum, but owing to its greater fusibility more care is needed in heating at a suitably slow rate.

The carbon furnaces are of rather a different type and are not nearly so economical. Their range is, however, greater, being limited only by the melting point of the clay in the case of a clay muffle, and if a muffle of carbon be used the range is nearly or quite up to 2000 degs. C. For lecture purposes a carbon furnace can readily be made by packing about a small porous cup, or a regular "D" muffle, a finely powdered mass of coke, and inserting the end of a carbon plate or rod in the coke on each side of the muffle. On applying a suitable voltage to the carbon rods a current of sufficient strength to heat the whole flows through the carbon. If, instead of a clay cylinder, we use a cylinder made of coke pressed together with some sticky hydrocarbon and then baked, we may carry the temperature well above the melting point of platinum. The coke powder requires constant stirring and the carbon cylinder slowly oxidizes, and crumbles. A sketch of this furnace is given in Fig. 2.

A small reduction furnace for making calcium carbide or carborundum for lectures may be made of a half-dozen bricks, a pair of electric light carbons, and a couple of retort stands. In the furnace sketched in Fig. 3 I have readily prepared calcium carbide and carborundum in a few minutes with a current of 50 amperes at 110 volts.

The use of electric heating devices has rendered possible such a complete control of temperature conditions that a very great field of temperature research is rendered available. A second and equally important advantage to be gained in the use of the electrical furnace in the laboratory is its freedom from fumes and dust which might cause injury to the contents of an ordinary combustion heated furnace.

The closeness of regulation of these small electrical muffles is surprising. I have found no trouble in holding them at any desired temperature up to 1000 degs. C., with a precision of between 4 degs. and 5 degs. The smallest amount readable on the pyrometer scale was 4 degs, so that with a method of reading smaller changes of tempera-

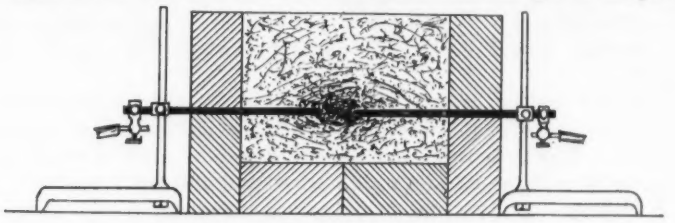


FIG. 3.—ELECTRIC FURNACE.

ture, and a more gradual introduction or removal of external resistance to control the current, a still more close regulation might be obtained.

As instances of the work which may be done upon furnaces of this kind I will mention the theses of three students in mining engineering—Messrs. Badlam, Roberts and Dorey—who graduated last year from the Institute. Mr. Badlam, to whose ingenuity much of the detail of this furnace is due, and who was the originator of the crinkling of the wire as a method of preventing the rupture of the wire by shrinkage, made a muffle about 2 ft. long for the study of the effects upon steel of heating to different temperatures with a subsequent cooling at any desired rate. I know of no other device in which one might, for instance, heat one bar of steel to 845 degs. C. and allow it to cool to 100 degs. C. in just eight hours, to take the next bar and heat it to 850 degs. C. and then cool at the same rate, and so on.

Dorey and Roberts used a similar furnace to study the decomposi-

tion of zinc sulphate as the temperature rises. Here it was necessary to be certain that the furnace was free from all fumes, and also to make the temperature, while gradually rising, pause if we desired at any point long enough to allow of as careful an examination of the contents of the furnace as was needed.

The Steam Turbine—I.

WHILE considerable has been written on the steam turbine, the literature of that subject is lacking with respect to descriptive practical detail. At the November meeting of the Engineers' Society of Western Pennsylvania Mr. Francis Hodgkinson, who has been closely identified with the development of the steam turbine, read a paper on this subject, and as it deals very largely with the practical side of the modern turbine, the paper will be reprinted in full in these columns, the first installment appearing below:

The earliest records of steam engineering are to be found among the relics of Ancient Egypt. About 120 B. C. Alexandria was at the zenith of her civilization. At this time Hero, probably contemporary with Euclid and Archimedes, wrote his celebrated work, "Spiritalia Seu Pneumatica." In it he describes several forms of mechanical apparatus: The use of the team jet for accelerating combustion; the expansion of air when heated in a closed vessel; several forms of steam boilers; various hydraulic apparatus for opening and closing temple doors. The most interesting among all these described is a reaction steam turbine. It consisted of a boiler, above which is a sphere mounted upon two trunnions. By means of these, steam is admitted to the interior of the sphere. On the equator were attached two bent pipes, such that the issuing steam reacted upon the sphere and caused it to revolve about its trunnions.

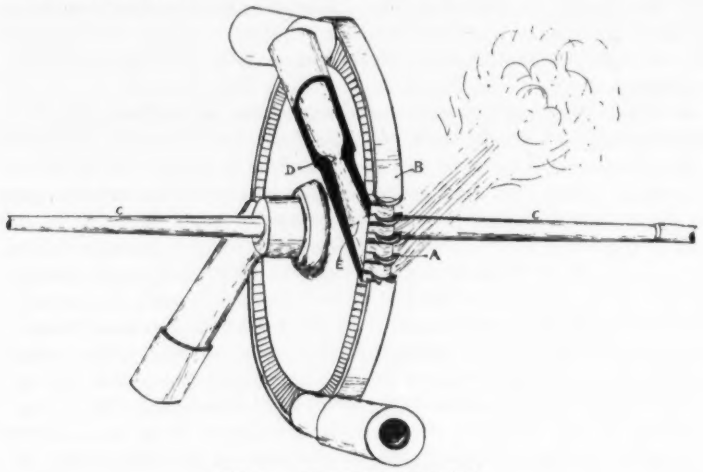


FIG. 1.—DE LAVAL TURBINE.

It is unknown whether this engine was ever more than a mechanical toy, although it is very possible it may have been used by the priests for driving, so-called, magical apparatus where high speed was desirable.

The next turbine, capable of any practical development, and which may be regarded as the forerunner of the de Laval turbine, was invented by Bianca in 1629. It consisted simply of a jet of steam impinging upon the vanes of a paddle wheel and blowing it around.

A century later, 1705, the reciprocating engine appeared, and from that time until the last few years, practically nothing was done in the development of steam turbines.

Before leaving this brief historical review, it is interesting to record that Mr. Parsons, with a view of exploring the possibilities of a reaction steam turbine, constructed one on the lines of Hero's engine. The sphere was replaced by two hollow oval sectional arms, mounted upon a hollow shaft, with jets at the outer ends through which the steam issued tangentially to the plane of motion. The whole was enclosed within a cast-iron case and connected to a condenser. With 100 lbs. per square inch at the jets, and 26 ins. vacuum in the exhaust casing, a speed of 5000 r. p. m. was attained and 20 horse-power developed. The consumption of steam was 40 lbs. per brake horse-power.

It is not a little remarkable that the latest development of steam engineering should be returning to the earliest form of engines of which we have record. It is still more remarkable that the engine, as described by Hero, had greater economy than any steam engine produced during the succeeding eighteen or even twenty centuries.

The fundamental principle of the steam turbine in contra-distinction to the reciprocating steam engine lies in the fact that the latter does work by reason of the static expansive force of the steam acting behind a piston, while in the former case the work is developed by the kinetic energy of particles of steam, which are given a high velocity by reason of the steam expanding from one pressure to a lower.

Steam turbines may be divided into three classes: First—Impact, of which Bianca's is an example. Second—Reaction, of which Hero's is an example. Third—A combination of both of these, of which Parsons' is an example.

It is proposed in this paper to deal only with the two forms which have attained some degree of commercial success; namely, the Parsons and the de Laval, particularly the former.

The general principles made use of in water turbines also apply to steam turbines. The buckets and guides must have as little skin friction as possible, and be so arranged that the acting fluid may strike without sudden shock, and have its direction of motion changed without sharp angular deflections. One difficulty, however, presents itself, and is due to the tremendous velocity of steam as compared with that of water under ordinary heads.

The laws governing the best velocity of buckets are the same as for water wheels. In the impact turbine the ideal condition is when the peripheral velocity of the buckets is one-half that of the fluid comprising the jet. In the reaction turbine this velocity must be equal to that of the jet in order to give us this ideal condition. Now with high pressure steam discharging into a vacuum, the velocities obtained are from 3000 to 5000 feet per second, as calculated by Zeuner's formula.

A turbine, therefore, built on the lines just enumerated would have peripheral velocities far beyond the limits of strength of material.

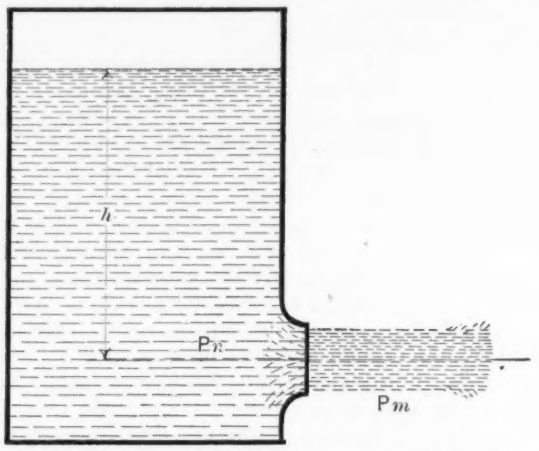


FIG. 2.—ILLUSTRATING ACTION OF STEAM IN NOZZLE.

As an example, a 10-inch Hero's engine would revolve at 75,000 revolutions per minute.

The de Laval turbine, shown in Fig. 1, consists of a divergent nozzle which directs the jet of steam upon suitably formed buckets, *A*, which are attached to the periphery of a revolving wheel. The outer edge of the buckets is shrouded by a steel ring, *B*, which prevents the centrifugal escape of the steam. The unique features of this turbine are the nozzle and the means by which the wheel is enabled to revolve upon its axis of gravity.

With regard to this latter point, a difficulty always arises in attempting to revolve a body at a high rotative speed. It is essential in the first place that the body be accurately balanced, but in spite of all care this cannot be attained with absolute accuracy. The result is that with ordinary shaft and bearings, tremendous vibrations would be set up that would probably result in eventual rupture of the shaft. De Laval overcomes this difficulty, however, by mounting his wheel near the center of a long light shaft, *C*, capable of being considerably bent and returning to its original form. The shaft is mounted upon bearings of ordinary construction. This flexibility enables the forces set up by the revolving wheel to deflect the shaft and enable the former to revolve about its axis of gravity.

The nozzle is divergent. In it the whole expansion of the steam is carried out. The steam at the mouth of the nozzle has the same pressure as the exhaust. In other words, the steam has its energy completely transformed into mass and velocity by the time it comes in contact with the buckets.

This brings up another feature of the turbine, which is that with

the exception of the nozzles, and the throats of the nozzles, no parts are subjected to steam pressure. It is well known that the velocity of steam flowing through an orifice from a greater to a lesser pressure increases as the difference of the pressure increases, only up to a certain limit. This limit is reached when the lower pressure becomes less than .56 of the higher. Beyond this, however much the steam pressure is increased, the velocity of steam remains practically the same—about 1476 feet per second. This limit of velocity is an anomaly, which seems to have been never satisfactorily explained. It is probably due to the fact that the pressure in the center of the throat is not the same as in the surrounding medium. The jet, after passing the throat, suddenly expands and the change of direction of the fluid particles gives rise to centrifugal forces. Experiments all show if a jet discharges from a reservoir of high pressure into a lower pressure, where the difference is greater than 56:100, the pressure in the throat of the nozzle is always equal to .56 of the absolute pressure of the reservoir, no matter how great may be the difference between the two pressures.

The action of steam in the nozzle may be further illustrated by Fig. 2. In this case, if the reservoir were filled with water the velocity issuing would be found by the formula $V^2 = 2gh$, where h is the actual feet head of water above the nozzle. In the case, however, of the fluid in the reservoir being steam or gas instead of water, h must be changed to an ideal head, which is the column of fluid necessary to give the given pressure at the level of the nozzle. This ideal head is equal to the feet head of water necessary to give the pressure, multiplied by the density of the water and divided by the density of the fluid in the reservoir. This formula, however, is only approximate, and is only good up to the before mentioned limits.

With small differences of pressure, such that Pm is greater than $.56Pn$, the fluid will issue with a velocity varying with the square

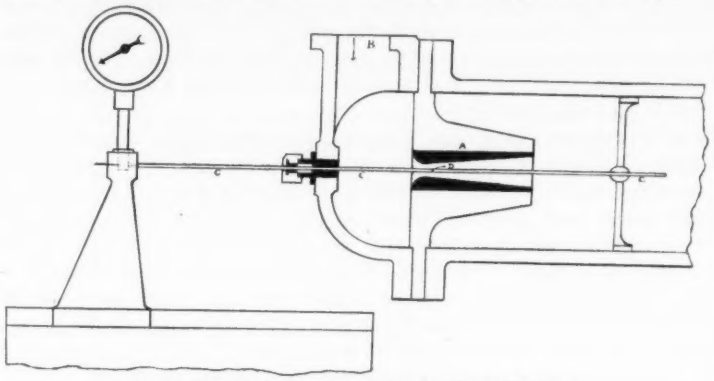


FIG. 3.—APPARATUS FOR NOZZLE EXPERIMENTS.

root of the ideal head, which will increase as the difference of pressures increases, until we reach the before mentioned condition of maximum discharge, and up to this point the steam will issue from the nozzle in substantially straight lines; this, of course, provided the nozzle has a well-rounded entrance, and not a condition that might be termed "an orifice in a thin plate."

When the pressure is increased beyond this, the steam expands partially outside the nozzle, and the particles cease to issue in a straight line as before. This subsequent expansion is taken advantage of by de Laval by means of his divergent nozzle, which is of the form shown in Fig. 1.

The throat is at D, having a well-rounded entrance, and from there on the nozzle diverges. The relation of the area of the outlet at E to the area of the throat at D should satisfy the condition that equal weights of steam pass at both the throat and the outlet in equal intervals of time.

Practically, a nozzle must be made with the area at the exhaust end as small as possible, for the sake of getting the greatest velocity, but just so large that the pressure will not be higher than that of the exhaust pipe.

The best length of nozzle is hard to determine. If too long there will be considerable loss of velocity due to skin friction. At the same time it must be long enough to admit of proper expansion of the steam. The best shape of the divergency has been the subject of investigation by various experimenters, in order to give the best expansion curve regarded as a single particle. The writer's opinion is that the best results in this respect are obtained by a nozzle whose section is very near an ellipse.

The investigation of the performance of steam nozzles is particularly interesting. The apparatus usually employed is shown in Fig. 3. The nozzle of the experiment is at A; the steam entering at B discharges through the nozzle directly into the exhaust pipe. At C is provided a small searching tube, sealed at one end and with a minute hole, D, some distance from this end. At the other end is provided a suitable pressure gauge or mercury column. Means are provided for sliding the searching tube with its pressure gauge back and forth, when pressures may be read with the hole in the searching tube in different positions throughout the length of the nozzle. From these figures a curve of pressure may be developed and from this, together with knowledge of the weight of the steam passing the nozzle per unit of time, and the exact form of the nozzle, a second curve may be developed which will give some idea of the velocities of the fluid.

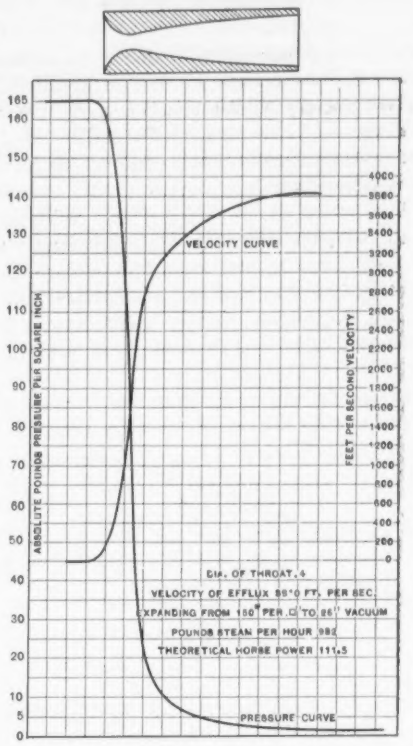
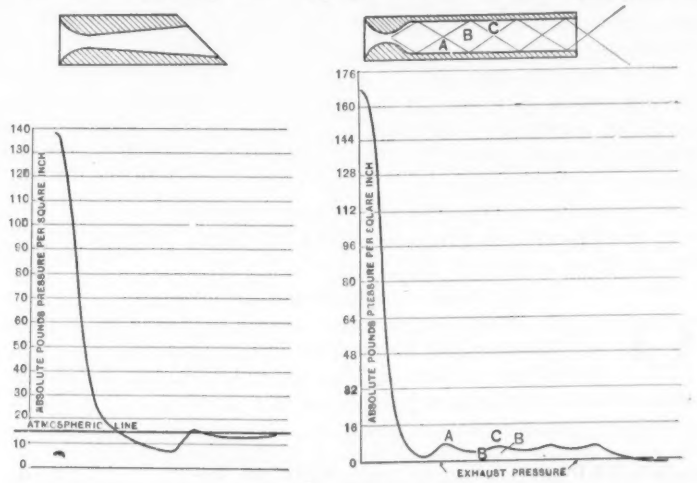

ABSOLUTE POUNDS PRESSURE PER SQUARE INCH
FEET PER SECOND VELOCITY
VELOCITY CURVE
DIA. OF THROAT .4
VELOCITY OF EFFLUX 98·0 FT. PER SEC.
EXPANDING FROM 150 PER G. TO 26" VACUUM
POUNDS STEAM PER HOUR 982
THEORETICAL HORSE POWER 111.5
PRESSURE CURVE

FIG. 4.—PRESSURE AND VELOCITY CURVES.

The curves of Fig. 4 give an example of this. They have, however, been developed theoretically on a basis of adiabatic expansion, that all the energy of the steam between the limits of pressure—150 lbs. gauge pressure and 26 ins. vacuum—has been converted into velocity, and that there are no losses due to skin friction or through loss of pressure by low coefficient of efflux. This coefficient of efflux is a feature of the entrance to the nozzle, and varies from 50 per cent in an orifice in a thin plate to 98 per cent in a well-rounded orifice, as is shown in Fig. 4.

The pressure curve is an adiabatic expansion line from the throat to the outlet, and the pressure of the throat is .56 times the absolute pressure of the steam before entering the nozzle. The velocity at the mouth of the nozzle is shown to be 3810 feet per second and 982 lbs. of steam passing per hour; diameter of throat 4-10 inch; theoretical horse-power 111.5. In actual practice as much steam as this could not be made to pass for the reasons just given, so the nozzle would require some modification in consequence.

Of course, in these investigations allowance must be made for the area of the searching tube. Fig. 5 shows an actual example of a



FIGS. 5 AND 6.—PRESSURE CURVES.

nozzle designed for discharging into vacuum, but used for discharging into atmospheric pressure, and shows how the steam reaches near the condition of vacuum near the outlet and afterwards rises to the exhaust pressure.

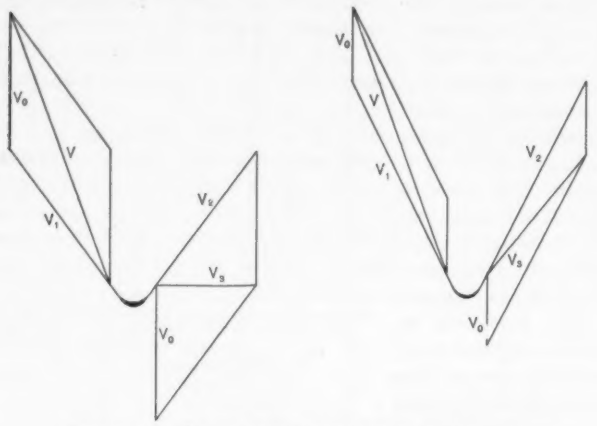
This feature is to a certain extent taken advantage of in a de Laval turbine designed for running non-condensing. The nozzle is slightly over-compounded so that the wheel may revolve in a partial vacuum.

Some gain in economy is the result by reason of the wheel revolving in a less dense medium.

Fig. 6 shows rather a curiosity. This form of nozzle was suggested as being as suitable as any that might have carefully constructed curved walls, and that the steam itself would take the correct passage and give the same results so long as the correct ratio of throat area and outlet area were maintained. It will be observed how the pressure line forms waves, which exactly correspond with some lines shown in the nozzle, which appear as though the steam particles fall very near to the exhaust pressure immediately on leaving the throat. They strike the walls and rebound, meeting together at the point *A*, where they form a point of pressure, again striking the walls at *B*, meeting again at *C*, and so on.

In the de Laval turbine the nozzles are set at an angle of 20 degs. with the plane of motion of the buckets, which is as acute an angle as is possible.

The action of the steam on the buckets may be shown by the diagram of parallelogram of velocities, Fig. 7, which shows an ideal



FIGS. 7 AND 8.—PARALLELOGRAMS OF VELOCITIES.

condition which could seldom be obtained in practice. V is the direction and velocity of the steam issuing from the nozzle; V_0 the velocity and direction of the buckets; component V_1 is the relative angle and velocity with which the steam strikes the bucket; V_2 is the *relative* direction and velocity of the steam leaving the buckets; V_3 is therefore the *absolute* direction and velocity of the steam leaving the buckets.

It will be observed here that V_3 is a horizontal line, so that the combination is one of maximum efficiency, the only losses being due to the angularity of the nozzle.

By reason of the tremendous velocities of steam, a diagram similar to Fig. 8 is what is generally obtained in practice. It will be noted that the angle of the bucket at the entrance corresponds with that of the component V_1. It is usual to have the angle of outlet making an angle with the plane of motion equal to that of the inlet with the same plane, thus taking away practically all end thrust.

These turbines, especially the larger sizes, are equipped with several nozzles, some of which are provided with independent stop cocks, such that the number of nozzles in operation may be adjusted to suit the condition of running in order to obtain the most suitable steam pressure in the throats.

The First Electric Light Plant in Boston.

BY ALTON D. ADAMS.

ONE year before electric arcs appeared in the streets of Paris, and two years before the historic lamp towers began to illuminate the heavens at Wabash, Ind., the first electric light plant in Boston was started.

This interesting event took place on Nov. 9, 1878, in a building occupied by the Continental Clothing House, at the corner of Howard and Washington Streets. The Mechanics' Fair, which is usually held at Boston during the month of October, had closed a few days previous to the above date, and the lighting plant that forms the subject of this sketch had been one of the exhibits. With an eye to advertising as well as with the desire for an improved method of illumination, the enterprising management of the above clothing house purchased the entire equipment of the plant in question, as exhibited, and had it immediately put into operation at their store.

This lighting equipment consisted of a small four-lamp Brush arc dynamo, four arc lamps, a quantity of No. 6 bare copper wire and a small upright Fitchburg engine with a throttling governor. Another dynamo of the Wallace-Farmer make was on exhibition at the same time, but this machine was removed from Boston after the close of the fair.

At the time this small Brush dynamo was constructed, its makers had not solved the problem of series operation for arc lamps, and the machine was therefore adapted to supply four independent circuits. The design of the older Brush dynamos is well suited to the supply of a number of independent circuits from a single armature, as those familiar with these machines will at once recognize. The Brush armature is a Gramme ring with enough room on the inside so that none of the coils lap over each other. Two coils diametrically opposite may thus readily be connected in series, as is actually done. Connecting wires for each pair of armature coils are taken directly out to the commutator and there joined to independent segments that have no electrical contact with the other coils. Commutator segments are arranged in circles of two or four segments each, so that the several rings of the commutator may each be connected to an independent circuit, or the brushes for all the rings may be joined in series and all of the armature coils used to supply a single circuit of lamps in series.

The small dynamo under consideration had four separate rings of segments in its commutator, with two segments, corresponding to a single pair of armature coils for each ring. An independent circuit for a single lamp was connected to the brushes of each commutator ring, so that four circuits left the machine. As these circuits were independent and each supplied only one lamp, regulation of the magnet strength, to correspond with changes in the number of lamps in operation, was unnecessary. These early arc lamps had no automatic cutout, so when the carbons burned out the lamp circuit, except that through the shunt spools, remained open. Regulation of current strength in each lamp circuit, to correspond with changes in the length of the arc, must have been attained by a drooping characteristic for its armature coils, due to their resistance and some increase in armature reaction.

The carbons used in these first arc lamps were square in section and about ⅜ in. on each side. It need hardly be added that they were not copper coated. No record remains of the volts at which the dynamo and lamps were operated, but as the arcs were open and long enough to give a strong white light, the pressure must have been 40 to 50 volts. Mr. Charles F. Brush was with the exhibit of his company at the Mechanics' Fair, above mentioned, and instructed the engineer of the Continental Clothing House, Mr. W. C. French, in the operation of the then mysterious lighting equipment.

The engine and dynamo were installed on the third floor of the building occupied by the clothing house, and a steam pipe was run up from a boiler in the basement, regardless of condensation losses. The four arc lamps were located on the first floor and the eight bare copper wires necessary to feed them were run down the sides of the elevator well, with blocks of wood to separate them from the iron parts.

As to operation, the plant was a great success from the start, and attracted large crowds of people to the store. It is related by the engineer above named that the third floor, where the engine and dynamo were located, was often so crowded with spectators that he could only get to the basement and fire the boiler in order to keep the plant running, with great difficulty. It is of interest to note among the costs of operation at that time, an item of 25 cents each for carbons; also, that this was shortly reduced to 6 cents each.

A number of visitors to this plant were connected with gas interests, and their surprise and alarm at the quantity and quality of the illumination was, if correctly reported, all that would have been warranted could they have foreseen the developments of the present day.

The four-lamp plant soon proved too small for the requirements of those who appreciated a good thing, and a six-lamp plant was shortly installed in its place. This next machine and its lamps were connected in series and operated on a single circuit. From time to time, as the requirements of the clothing business increased, larger arc dynamos were installed, until finally the plant contained two Brush arc dynamos with a capacity of 30 nominal 2000-cp lamps each. These two machines were continued in operation down to the summer of 1897, when they and their lamps were finally displaced by constant pressure generators and enclosed arcs. Mr. W. C. French, who remained in charge of the plant of the Continental Company through all of its changes, has perhaps operated an electric lighting equipment longer than any other engineer in the United States.

Testing the Capacity of Turbines.

BY EDWARD P. BURCH.

THE manufacturer who designs and installs water turbines usually gathers the data on the performance of his wheels from tests made at the Holyoke testing flumes. While these tests are accurately made, the results sometimes prove to be quite unreliable to the user of the turbine. Discussing the subject:

In test, a single wheel may be calibrated on a vertical shaft and on low heads of water at different gate openings. It is found that at each tenth gate tested, the turbine shows a certain economy and capacity at a certain speed. From the tests, it is computed that on any other head the capacity will change with the number of separate turbines on the shaft and with the square root of the head cubed; also, that the most economical speed will vary as the square root of the head. This relation of horse-power and speed to head is quite approximately correct with an unlimited supply of water, when the computations do not involve great change in head; i. e., the errors are small in changing from 15-ft. to 17-ft. head, though much larger in changing from 15-ft. to either 4-ft. or 40-ft. head.

For example, on 15 ft. acting head and full gate, a vertical wheel develops 250 horse-power at 115 revolutions; from which it may be calculated that two pairs of similar wheels on a horizontal shaft and with different sizes and styles of flume, etc., would on full gate and with 20 ft. acting head develop $4 \times 250 \times \sqrt{\left(\frac{20}{15}\right)^3}$ or 1540 horse-power, and that the most economical speed would be, $115 \times \sqrt{\frac{20}{15}}$ or 132.8 revolutions. The capacity and speeds at other gates may also be calculated from corresponding data.

Such calculations are only approximate and are found to vary materially with different settings, flumes, chamber proportions, etc., much as the settings, draught, etc., of a boiler change its economy and capacity.

A résumé is given below of a test recently made by the writer to check such calculations at a 10,000-hp electric railway power station, at which all of the water power was rented to an operating company. Accurate information from tests was desired on the horse-power capacity of three different-sized turbines on 20-ft. head, at each tenth gate, and also the curves to show how the capacity varied with the speed. For it is well known that with a given head and quantity of water, the maximum capacity and greatest economy occur at one speed only. An increase or decrease from this speed decreases both the capacity and economy.

The plant contains, in addition to exciting units, ten horizontal turbines of different sizes, rated by the manufacturers at about 1300 horse-power each on 20-ft. head, at 130 revolutions.* Many similar units from the same and similar patterns are in service in the United States and in Canada. Each turbine unit was direct-connected to a generator whose capacity may be rated at 750 kilowatts, American Institute rating. The generators tested were triphase star-connected alternators rated at 2000 volts per phase, or $2000 \times \sqrt{3}$ or 3450 volts between legs. It was necessary to drive these generators at approximately 130 revolutions in order to obtain the proper cycles and transmission voltages. Knowing the output of the generator accurately at any given head, gate opening and speed, the problem then was to measure the above variables. The efficiency curves of the generator had previously been made by the Hopkinson method and checked by measuring each loss separately. Under test, the gate opening for any set of readings was constant, the head remained approximately constant and could be corrected by using the formula given above. By varying the load on the generator, the speed would vary inversely.

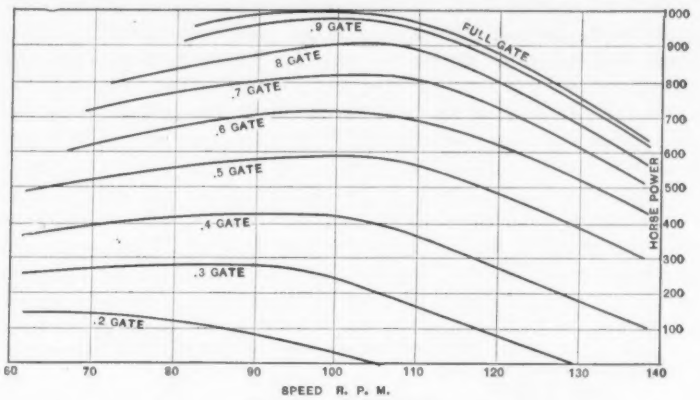
No attempt was made during tests to measure the efficiency of the turbines or the cubic feet of water per second flowing through them. Some very interesting failures were made in attempting to measure the mechanical friction of the turbine, using a synchronous motor.

In order to get a suitable load, a water rheostat was built having the following constants: From the three corners of a horizontal triangular frame made of pine 2 x 4 timbers there were suspended, on insulators, three pieces of 4-in. wrought iron pipe each 4 ft. long and set 3 ft. apart. This water rheostat when adjusted to the above dimensions was suited to the maximum and minimum load by simply varying its height in the water. It was placed in an idle turbine chamber where the water was quiet so as to avoid fluctuations. No salt or soda was used, results being found more constant without them. When the rheostat was absorbing 880 kilowatts it was submerged one foot under water.

A large-scale speed recorder was made and calibrated. The gate readings were accurately checked. The elevation of the water in the turbine chambers and that from the draft tubes was carefully measured by schemes found most reliable. One set of pressure pipes showed the difference between the water in the forebay and the turbine chambers, another the difference between the elevation of the water at the draft tube outlets and the tail-race. The difference in the average elevation of the water in the turbine chambers and that at the draft tubes gives the acting head. Measurements were taken every minute and recorded by seven assistants at the sound of a gong. Three hours were required for each turbine tested. These observers were in such positions that, except for one man, they did not know the conditions or the load carried by the turbine. Their readings were thus unbiased by expectancy. Many details not here noted were found advantageous or necessary.

The electric power was measured by a Weston indicating wattmeter which was calibrated before and after test, the change being negligible. The current was practically equal in the three legs of the circuit, and normally the power-factor varied from 99 to 100 per cent. The kilovolt-amperes thus gave check to the wattmeter except on abnormal cycles.

The results of the test on one of the turbines are shown by the accompanying curves. For obvious reasons the actual results are not



TESTING TURBINES.

published. It is believed that the characteristic curves are interesting. The speed is plotted along the base line and the horse-power output of the turbine is plotted vertically. The curves are for each tenth gate opening. The speed and horse-power at other heads may be calculated approximately from the data given. Other curves may be drawn with the gate openings as abscissae, for either the maximum capacity or the capacity at any particular speed.

One set of comparable readings showed that by entirely cutting away the turbine entrance walls temporarily, the capacity of the turbine was increased 11.1 per cent; by redesigning the entrance walls as far as was considered best for structural reasons, the capacity of the turbines was permanently increased at least 5.4 per cent.

By using an electric generator and absorbing the power in a water rheostat, much better results were obtained than with a Prony brake which had been tried on the same turbines. The advantages are simplicity and rapidity.

Since engineers thus have at their command a convenient method of determining the capacity of turbines, the suggestion is offered that this capacity should be tested under operating conditions at our hydraulic plants. The results locally will be valuable and will also help turbine manufacturers. They are not able at present to get over 77 per cent efficiency out of turbines of this type. This efficiency is often decreased by running turbines at the wrong speed or with insufficient water inlets, bad settings and wrong design of cases, flumes, draft tubes, etc. There is also offered a rapid method of experimenting on blade and guides of different forms at a testing flume which uses electric generators with known efficiency. The power measuring instrument similar to an indicating wattmeter could read directly in horse-power.

The contribution is offered in hope that the efficiency of turbines and the design of turbine settings may be improved. The writer is under obligations to Mr. Wm. de la Barre, engineer for the St. Anthony Falls Water Power Company, of Minneapolis, by whom he was employed to make these tests, for permission to publish notes and curves on the same.

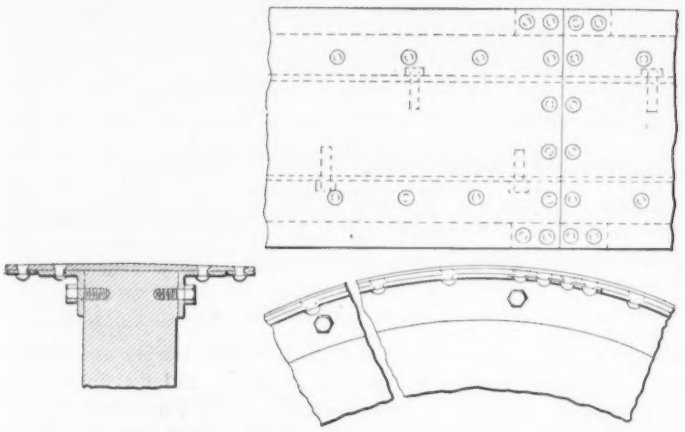
*Detailed drawings and photographs of station, turbines, chambers, generators, etc., are given in *Proceedings* of Northwest Railway Club, April, 1900; abstracted in *Street Railway Journal*, Aug. 11, 1900.

Electric Motor Drive for Mills.

BY ALEXANDER ANDERSON.

MANAGERS of large manufacturing establishments should consider the most economical methods, not only for the immediate present, but also for their future needs. Few mills or factories now stand as originally built; practically all have undergone modification and enlargement. On this account small engines and boilers are found throughout the various buildings of many factories not using electric power, or steam is carried long distances to the engines, with heavy losses due to condensation. The modern plan discards all the small and inefficient engines and substitutes a single electric plant for generating power of maximum efficiency. The higher economy of large units is generally recognized, but the saving in power which a central generating plant may effect is an important through frequently overlooked commercial consideration. Separate power units scattered over a large mill require many times the labor necessary to operate a single plant of equal capacity. In the central electric plant the size of the steam units may be chosen so that they may be operated at their most efficient load. Losses in transmission of power by shafting vary widely, depending on the class of work, arrangement of machines, relative direction of shafts and their adjustment, lubrication and alignment. The instability of supports which are frequently placed under floors subject to variable weights, are often a source of increased friction and loss.

Tests are usually made by taking comparative engine indicator diagrams with shafting alone and with the machinery in full operation. They do not include all the transmission losses, as they neglect the



METHOD OF EXTENDING WHEEL FACE.

power lost in slipping belts, etc., under load. The results show that the average efficiency by ordinary methods of transmission is from 30 per cent to 60 per cent—in other words, the losses are from 65 per cent to 230 per cent of the effective power delivered to the machines to be operated. Some tests show as low an efficiency as 25 per cent, and only in rare cases an efficiency of 75 per cent at full load.

In the electric system, on the other hand, the loss in transmission can be exactly predetermined, and usually varies, depending on the investment in copper, from 2 per cent to 10 per cent. The losses in the generator and motor together will be from 15 per cent to 25 per cent, depending on the size of the units. To this must be added the loss in transmission, giving a total efficiency of from 75 per cent to 83 per cent, from engines to machines operated.

This means, in other words, that to deliver 150 horse-power to machinery with shafting transmission having 50 per cent efficiency, 300 horse-power capacity will be required. With electric transmission, using motors having an average of 85 per cent efficiency at full load and a line loss of 5 per cent, which is only limited by the cost of copper, we must deliver at least 186 horse-power to the transmission line, and as a generator of this size should have an efficiency of 92 per cent, the total loss from the pulley of the engine to the machine tool is about 25 per cent, or an efficiency of 75 per cent in the drive. The required engine will, therefore, be 202 horse-power against 300 horse-power for a shafting drive at average load. This comparison is made with the same engine doing both kinds of word, it being belted to the generator. If the generator were direct connected the belt slippage loss and dynamo bearing friction would be eliminated and the general efficiency would be raised 3 per cent to 7 per cent.

When the National Lead Company decided to increase its manufacturing plant at the Jewett Mill on Staten Island, Messrs. Floy & Carpenter, of New York, their consulting engineers, recommended after a thorough examination of the present power plant and calculation of the power required for the new mill, that the spare power be utilized of the present large Corliss engine, which was underloaded, and is located in the old mill on the opposite side of the street from the new one. The engineers decided on an electric drive, the generator to be operated by this engine. The space was limited, and the generator could not be direct connected, so it was decided to belt this machine to the flywheel of the engine, which has a rim of heavy section with 8-in. face, 20 ft. in diameter. It was necessary to increase the face of this wheel to 21 ins., so that it might drive a 20-in belt. This was carried out successfully by bolting a 4-in. angle-iron around both edges of the rim, and then rivetting a steel plate face on the wheel, as shown in the accompanying sketch. It was then turned off true and crowned, and is giving perfect satisfaction.

The generator is a 150-kw General Electric two-phase, 225-volt, 60-cycle compensating alternator. This particular style of machine was selected because of large variations in the reactance of the load, which is almost entirely two-phase induction motors. It automatically adjusts its field for all kinds and degrees of load. The shaft carries the revolving field of the generator and armature of the exciter, which has the same number of poles as the alternator, so that the two operate in synchronous relation. The switchboard is made from blue Vermont marble and is equipped with quick-break switches, circuit breakers, two ammeters, a voltmeter and a Thomson two-phase induction recording wattmeter, which registers the entire output of the generator. The current is conducted from the switchboard to the mill by lead-covered cable, drawn through a conduit which crosses the street, and is distributed to the various motors from a large distribution panel. The motors are direct connected where possible—one or two being belted where a very slow speed is desired. The lighting is also done from the same feeders, single-phase circuits being run from either side of the two-phase transmission, using 225-volt lamps. The mill is turning out several tons a day more white lead than the company figured was possible when it was first contemplated. As a matter of fact, there is not a mill in existence of the same size giving such a large output of this product in twenty-four hours. This is mostly due to the fact that the electric motors maintain a constant speed, and the usual loss from belt slippage and shafting friction is eliminated. If this mill had been driven by a separate engine and shafting transmisson it would require another engineer and a long line of steam pipe, which would condense considerable steam, and it would have been impossible to obtain the above results.

Meeting of the Röntgen Society.

The first meeting of the Röntgen Society of the United States was held at the Grand Central Palace, New York, on Dec. 13 and 14. There was a large attendance, the West being strongly represented, which may be to some extent due to the fact that the headquarters of the society are in the West, while the principal officers are residents of the same section.

President Dr. Heber Robarts opened the proceedings with an address in which he outlined the evolution of the Röntgen ray, the life of its discoverer, and the history of the society, the founder of which was Dr. J. Rudis-Jicinsky, the society's secretary. He compared the Röntgen-ray photographs of four years ago with the perfect results obtained to-day, and pointed out the necessity for standardizing some method for accurate diagnosis and therapy. This must be done, he said, before the science will be acceptable to intelligent people, and especially to the courts. He proposed that diagnosis be standardized first and then an improved therapy for the Röntgen ray be fixed upon.

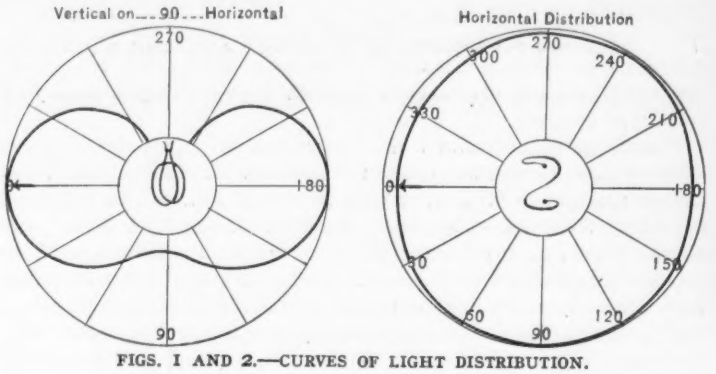
Several papers on the theory and practice of the Röntgen ray in therapeutics were read and earnestly discussed by the members. Skiagraph is the term used by the society for Röntgen-ray prints.

On Dec. 14 Mr. E. W. Caldwell, of New York, gave a demonstration of electrolytic interrupters. The election of officers for the ensuing year resulted as follows: Dr. Heber Robarts, of St. Louis, president (re-elected); Dr. J. Rudis-Jicinsky, of Cedar Rapids, Ia., secretary (re-elected); Dr. E. A. Florentine, of Saginaw, Mich., treasurer. The place of the next meeting was not decided upon, but will probably be Buffalo or Philadelphia.

Elements of Illumination—XVII.

By Dr. Louis Bell.

CONTINUING the subject of the last part of this article, many early incandescent lamps, for example, had filaments of square cross section bent into a single simple U. These gave their rated candle power in directions horizontally 45 degs. from the plane of the filaments and this was the maximum in any direction, so that the lamp was really credited with its maximum candle power, and fell below its rating in all directions, save the four horizontal directions just noted. It is customery to delineate the light from an incandescent lamp in the form of closed curves of which the various



FIGS. 1 AND 2.—CURVES OF LIGHT DISTRIBUTION.

radii represent in direction and length the relative candle power in those various directions. Such curves may be made to show accurately the distribution of light in a horizontal plane about the lamp, or the distribution in any vertical plane and from the average radii in any plane may be deduced the mean candle power in that plane, while from a combination of the radii in the various planes may be obtained the mean spherical candle power which measures the total luminous radiation in all directions. This last is the true measure of the total light-giving power of a lamp. Fig. 1 illustrates the curve of horizontal distribution for one of the early lamps, having a flat U-shaped filament. The circle is drawn to show a uniform 16 candle power, while the irregular curve shows the actual horizontal distribution of light. This particular lamp overran its rating, but its main characteristic is that it gave a strong light in one horizontal diameter and a weak one in the diameter at right angles to this. Such a distribution as this is generally objectionable, and most modern filaments are twisted or looped, so that the horizontal distribution is nearly circular. Fig. 2 shows a similar curve for a recent 16-cp lamp of the type shown in Fig. 1 of the last paper. In the small inner circle is shown the projection of the looped filament as one looks down upon the top of the lamp. Fig. 3 shows a similar delineation of the distribution of light in a vertical plane taken in the azimuth shown in Fig. 1, with the

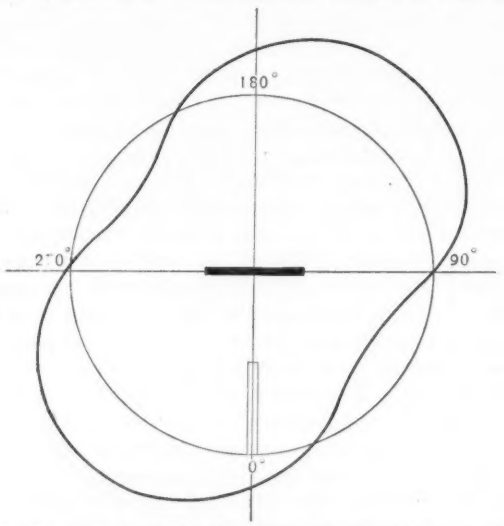


FIG. 3.—DISTRIBUTION OF LIGHT ON VERTICAL PLANE.

socket up. The looping of the filament is such that the horizontal distribution is very uniform, while in the vertical downwards there is a marked diminution of light, and of course in the direction of the socket much of the light is cut off. The total spherical distribution, if one can conceive it laid out in space in three dimensions, resembles a very flat apple with a marked depression at the blossom end and a cusp clear in to the centre at the stem end. Fig. 4 is an attempt to display this spherical distribution to the eye. If the filament is a simple U or the double U of Fig. 2 in the last paper, assuming the same total length and temperature of filament, the apple would have still greater diameter, but the depression at the blossom end would

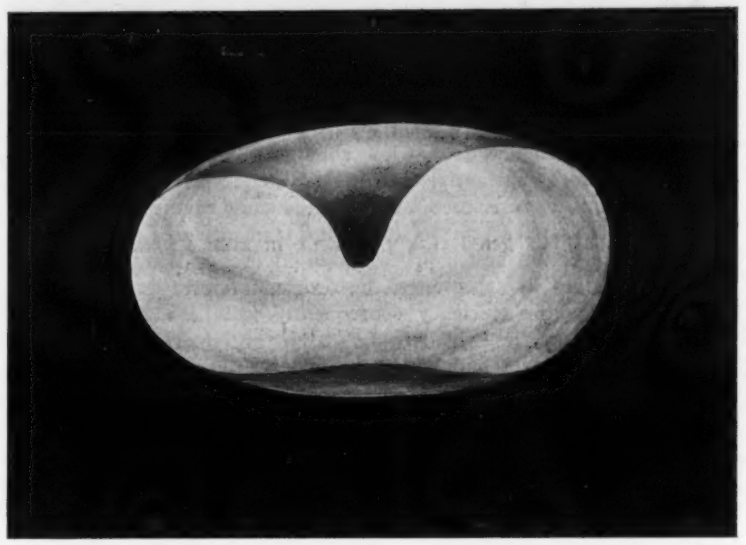


FIG. 4.—SPHERICAL DISTRIBUTION.

be considerably wider and deeper. If the filament has several convolutions as in Fig. 5, accidentally omitted from the last paper, this depression is considerably reduced, but there is a marked flattening in one horizontal direction, so that the horizontal distribution would somewhat resemble Fig. 1. But all the apples would have the same total bulk. If the lamps were rated by their mean horizontal candle power the U filament would show abnormal horizontal illumination for the energy consumed, and would apparently be very efficient, while if one were foolish enough to rate lamps by the light given off the tip, Fig. 5 would show great efficiency, one horizontal diameter having been skinned to fatten the curve at the tip. In reality, however, each one of the three forms of lamp would have exactly the same efficiency, and in practice there would be little choice between them.

In the every-day work of illumination, incandescent lamps are installed with their axes in every possible direction, the vertical being the rarest, and angles between 30 degs. and 60 degs. downwards from the horizontal the commonest. Bearing in mind this general distribution of the axes and the fact that diffusion goes very far toward obliterating differences in the spherical distribution as regards general illumination, it is easy to see that the shape of the filament is, for practical purposes, of little account. In the few cases where directed illumination is needed it is best secured by a proper reflector which gives far better results than can be obtained by juggling with the shape of the filament. The thing of importance is to get uniform filaments of first-class durability, and as good efficiency as possible. The only proper test for efficiency, however, is that based on mean spherical candle power, since a lamp will give a different apparent efficiency for each direction of measurement, varying from zero in the direction of the socket to a maximum in some direction unknown until found. Efficiency has most often been taken with respect to the mean horizontal candle power. But this leads to correct relative results only when comparing lamps having fiaments similarly curved. The mean spherical candle power is from 80 to 85 per cent, usually, of the mean horizontal candle power, a ratio larger than is found in the case of any other artificial illuminant.

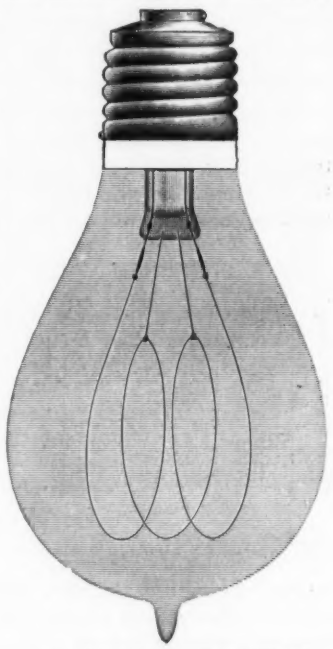


FIG. 5.—LAMP WITH THREE-CONVOLUTION FILAMENT.

As regards efficiency, most commercial incandescent lamps require between 3 and 4 watts per mean horizontal candle power. Now and then lamps are worked at 2.5 watts per candle when used with storage batteries, and some special lamps, especially those made for voltages above 200 range, over 4 watts per candle. As has already been remarked, the efficiency depends upon the temperature at which the carbon filament is worked. And it is in the ability to stand protracted high temperature that filaments vary. It is comparatively easy to make a filament which will stand up well when worked at 4 watts per candle, but to make a good 3-watt per candle filament is a very different proposition. Also, at low voltage, 50 volts for instance, the filament is more substantial than the far slenderer one necessary to give the requisite resistance for use at the same candle power at 100 or 125 volts. Under protracted use the filament loses substance by slow disintegration and a process akin to evaporation, so that the surface changes its appearance, the resistance increases so that less current flows, the efficiency consequently falls off and the globe shows more or less blackening, from an internal deposit of carbon. The thinner and hotter the filament the less its endurance and the sooner it deteriorates or actually breaks down. Modern carbons have by improved methods of manufacture been developed to a point that in the early days of incandescent lighting would have seemed beyond hope of reach. But the working voltage has steadily risen and constantly increased the difficulties of the manufacturer.

So-called high efficiency lamps worked at about 3 watts per candle power require the temperature of the filament to be carried so high that its life is seriously endangered unless it be of fair diameter, hence such lamps are hard to make for low candle power or for high voltage, either of which conditions requires a slender filament in the former case to limit the radiant surface, in the latter to get in the needful resistance. An 8-cp 125-volt lamp, or a 16-cp 250-volt lamp presents serious difficulties if the efficiency must be high, while conversely lamps of 24 or 32 candle power are far more easily made for high voltage. The annexed table gives a clear idea of the performance of a modern lamp under various conditions of working. It is from tests made on a 16-cp 100-volt lamp (so called) by Prof. H. J. Weber. The total radiating surface of the filament in this lamp was 0.1178 sq. in., so that the intrinsic brilliancy was over 250 candle power per square inch.

Amperes.	Volts.	Watts.	C.p.	Watts ℘ c.p.	Temperature.
0.421	77.19	32.51	2.99	10.87	1464°C.
0.443	80.89	35.85	4.13	8.67	1483
0.467	84.80	39.58	5.60	7.07	1503
0.490	88.83	43.55	7.41	5.88	1522
0.513	92.87	47.70	9.71	4.91	1541
0.536	96.71	51.84	12.42	4.18	1557
0.559	100.60	56.21	15.76	3.57	1574
0.582	104.58	60.90	19.70	3.09	1591
0.605	108.60	65.78	24.25	2.71	1607
0.629	112.57	70.85	29.41	2.41	1621

The absolute values of the temperatures here given are the least exact part of the table, but their relative values may be pretty safely trusted. Fig. 6 shows in graphical form the relation between the last two columns, showing clearly how conspicuously the efficiency rises with the temperature. At the upper limit given the carbon is too hot

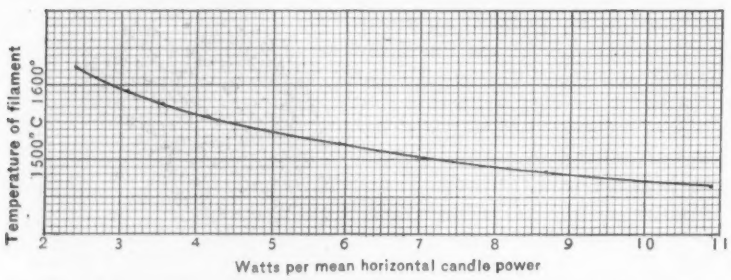


FIG. 6.—CURVE SHOWING RELATION OF WATTS PER C. P. TO TEMPERATURE.

to show a long life, although the writer has seen modern lamps worked 12 volts above their rating for several hundred hours before rapid breakage began. Of course the brilliancy had fallen off greatly, however, by this time.

It is worth noting from the table that for a 16-cp lamp of ordinary voltage the candle power varies to the extent of quite nearly one candle power per volt, for moderate changes of voltage from the normal. Weber calls attention to the fact that between 1400 degs. and 1650 degs. an increase in temperature of n degrees corresponds very closely to a saving of energy of n per cent in the production of light. If it were possible to carry the temperature still higher without seriously imparing the stability of the filament, lamps of a very high economy could be produced. It is posible to force lamps up to an efficiency of even 1.5 watts per candle temporarily, but they often break almost at once, and even if they hold together they rise to 2 or 2.5 watts per candle within a few hours. To tell the truth, the temperature corresponding to 1.5 watts per candle is dangerously near the boiling point of the material, so near that it is practically hopeless to expect any approximation to such efficiency from carbon filaments, and even at 2.5 watts per candle the life of the lamps is so short that at present prices they cannot be used commercially.

From such experiments as those tabulated it has been shown that the relation between the luminous intensity and the energy expended in an incandescent lamp may be expressed quite nearly by the following formula:

$$I = aW^3$$

wherein I is the candle power, W the watts used and a is a quantity approximately constant for a given type of lamp but varying from type to type.

Following the universal rule of incandescent bodies the radiation from an incandescent lamp varies in color with the temperature, and thus as the voltage changes, or what is about the same thing, as lamps of different efficiencies are used, the color of the light varies very conspicuously. Low efficiency lamps, or lamps in a low stage of incandescence, such as are indicated in the first four lines of the table, burn distinctly red or reddish orange. Then the incandescence passes through the various stages of orange yellow and yellow white until a 3-watt lamp is nearly and a 2.5 watt lamp purely and dazzlingly white. The color is a good index of the efficiency.

The sizes of incandescent lamps in fairly common use are 8, 10, 16, 20, 24, and 32 candle power. The standard in this country is the 16-cp size, a figure borrowed from the legal requirements for gas. Some 10 candle power are used here, very few 8 candle power, and still fewer of candle powers above 16. Abroad 8-cp lamps are used in great numbers and with excellent results, and 20 and 24-cp lamps are mostly found in high voltages for reasons that will appear shortly. Four and 6-cp lamps are now and then used for decorative purposes or for night-lights and excellent 50-cp lamps are available for cases requiring radiants of unusual power. Lamps of these various sizes are made for voltages usually between 100 and 120 volts and more rarely for 220 to 250 volts, but in the latter case lamps below 16 candle power are almost unknown. One hundred and ten volts was for some years the standard pressure here, and with this as a basis, one may profitably see what are the problems to be met in lamp construction. At this voltage the filament of a 16-cp lamp is 6 or 8 inches long and .008 to .01 inch in diameter, and ordinarily has a resistance when hot of nearly 200 ohms. Now to produce an 8-cp lamp of the same voltage and efficiency the energy consumed must be reduced by one half and so also must be the radiating surface. This means that the filament resistance must be doubled and the radiating surface so adjusted by varying the length, diameter, and specific resistance as to give the required candle power. The latter two factors can be varied during the process of flashing, since the carbon deposited thus is denser and of lower specific resistance than the original squirted core. The net result is a filament somewhat shorter and slenderer than the 16-cp filament and usually of less stability. On the other hand, in making a 32-cp lamp the filament may conveniently be made longer, thicker and more durable. In lamps of higher voltage the filaments must be of much higher resistance, and hence longer and thinner, until at 220 volts the 16-cp lamp must have four times the resistance of its 110 volt neighbor, and will have a total length of 12 to 15 inches. In these lamps of small candle power or of high voltage there is some temptation to get resistance by flashing the filaments less thoroughly, to the detriment of durability, since the soft core disintegrates more readily than the hard deposited carbon, which may explain the frequent inferiority of such lamps. The greater the candle power, and the less the efficiency required,—*i. e.* the greater the permissible radiating surface, the easier it is to get a strong and durable filament for high voltages. Hence, lamps for 220 to 250 volts are generally of at least 16 candle power, very often of 20 or 24 candle power, and seldom show an efficiency better than 4 watts per candle power. This forms a serious practical objection to the use of such lamps for general distribution, unless with cheap water power as the source of energy, and while improved methods of manufacture are likely somewhat to better these conditions, yet there are inherent reasons why it should be materially easier to produce durable and efficient incandescent lamps of moderate candle power and voltage, than lamps of extreme properties in either of these directions.

The life of incandescent lamps practically depends on the temperature at which they are worked, other things being equal. There is a steady vaporization and disintegration of the carbon from the moment the lamp is put into service, which ends in a material increase in the resistance of the filament with accompanying decrease of the current, energy, temperature, efficiency and light. If the lamp is started at a low efficiency the temperature is relatively low and the decadence of the filament is retarded, while if the lamp is initially of high efficiency the filament under the higher temperature deteriorates more rapidly and the useful life of the lamp is shortened. Under this latter condition the cost of energy to run the lamp is diminished, but at the cost of increased expense in lamp renewals. Operating at low efficiency means considerable cost for energy and low cost of the lamp renewals. Between these a balance has to be struck.

Some Recent Tests of American Iron and Steel.

BY J. WALTER ESTERLINE AND ROBERT B. TREAT.

MARKED improvements in the methods of electrical design and the wide range of variation of the magnetic quality of the material used in the construction of electrical machinery, have created a demand for definite, accurate knowledge concerning the quality of the iron and steel used. The magnetic properties must be known in order to closely predetermine the operation of a machine to be constructed; a point especially important in the design and construction of large, special machines built on guarantee contracts.

The fact that the product of different makers of commercial irons, as well as the output of the same manufacturer, varies greatly in its magnetic quality, makes it imperative that the builder of the machines make frequent tests in order to detect and exclude the poor grades of material.

The authors have been, for several years, making tests of iron for manufacturers of machinery, foundries and rolling mills. In comparing the results of some of these tests, which were made on material coming from all parts of the country, a wide variation in magnetic quality was apparent and it was thought that perhaps a more extended and thorough series of tests, sufficient to give an accurate notion of this variation, might be interesting and profitable.

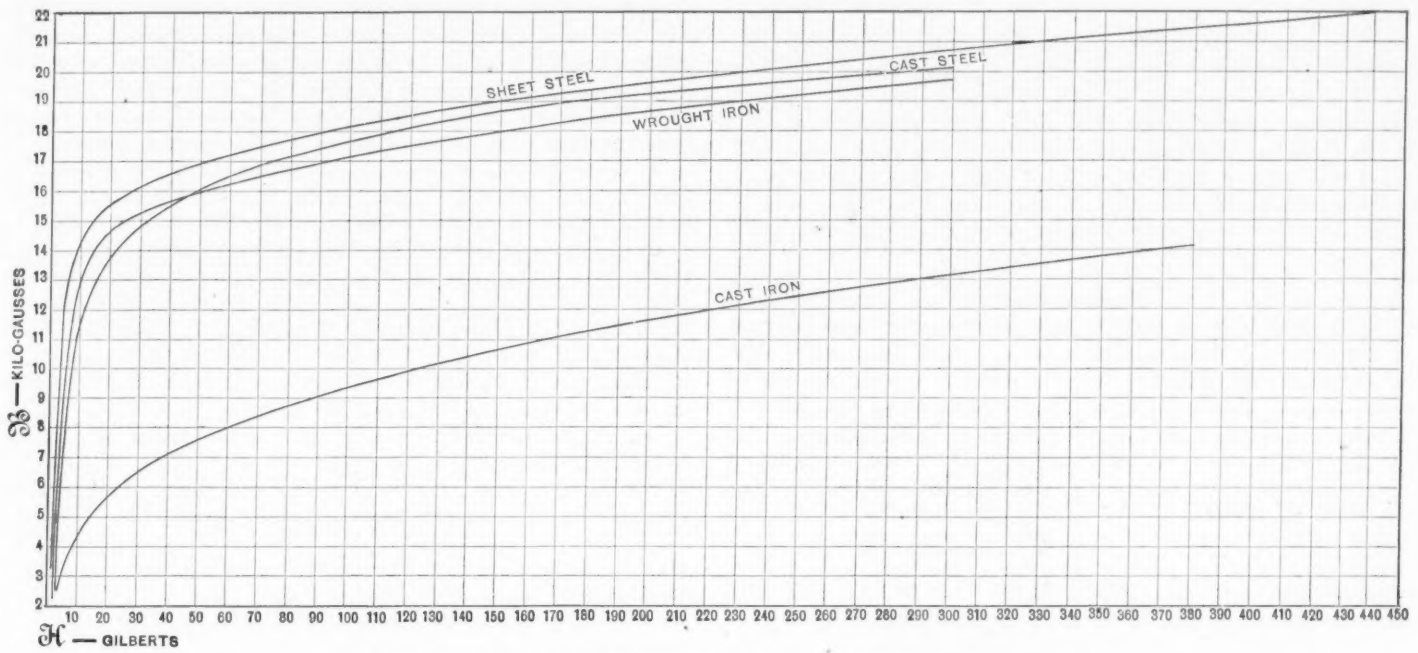
To this end, letters were addressed to nearly all of the important companies manufacturing electrical machinery in this country, requesting them to furnish samples of cast iron, cast steel, wrought iron, sheet iron and sheet steel they were using at that time. The response was more than liberal, and may perhaps be taken as a measure of the interest taken in this subject, some manufacturers sparing no pains and expense to furnish suitable specimens. Twenty companies sent more than one hundred samples of material, the preparing and testing of which was a task of a little greater proportions than was apprehended at the time of writing the letters.

The samples were all in the form of bars, and were tested in a special apparatus designed and made by the authors.* Care was taken to exclude sources of error, and all the bars were tested under similar conditions. In order to economize space the curves have been plotted on the sheets without dividing the different kinds of metal into groups. This is done in the tables, and the densities at different values of $\mathfrak{H}$ as well as the history of the iron is given. The curves of cast iron, cast steel and wrought iron were carried to a value of $\mathfrak{H} = 150$, which exceeds the limit reached in practice, but gives a better opportunity for comparison. The density in the teeth of armature cores being sometimes very high, it was deemed advisable to run the curves of sheet metal to a value of $\mathfrak{H} = 450$; this was done, but the curves only show the relation up to $\mathfrak{H} = 150$, the values of $\mathfrak{B}$ for $\mathfrak{H} = 450$ are given in Table IV.

TABLE I.
Cast Iron.

No.	$\mathfrak{B}$ $\mathfrak{H}=10$	$\mathfrak{B}$ $\mathfrak{H}=100$	REMARKS.
27	2300	9340	Soft gray iron used in the field yokes of large alternators.
18	2100	8880	Ordinary scrap cast iron, a jet of steam forced in cupola before drawn.
12	2100	8570	Soft iron, large coarse crystals.
39	4200	9450	Curve very good for low values of $\mathfrak{B}$
47	4800	9180	The best grade.
42	3800	9250	
46	4000	9600	
1	4360	9380	Soft gray iron good quality.

The samples coming from so many and such varied sources, little can be said of the physical treatment to which the material has been subjected, but where known it has been indicated in the tables.



CURVES OF MAGNETIC QUALITIES OF AMERICAN IRON AND STEEL.

Of thirteen samples of cast iron tested, eight are tabulated; the cast iron curves show a wide variation throughout the useful range, but rather more uniformity at the higher values of $\mathfrak{B}$ and $\mathfrak{H}$. The wrought iron bars tested were few in number, but gave by far the greatest uniformity. By comparison with Tables II and III it is noticeable that in every case the wrought iron is more susceptible at the low values of magnetic force, but is excelled by cast steel at the higher values. The samples of cast steel shown in Table III are representative, being the product of eight different furnaces. For $\mathfrak{H} = 10$, $\mathfrak{B}$ varies from 6400 to 13,200 gausses, too great a difference when it is known that all these materials are made especially for the electrical trade. No. 26 in finishing appeared to be a superior piece of metal, being tough and uniform, but on being tested gave a very low

TABLE II.
Wrought Iron.

No.	$\mathfrak{B}$ $\mathfrak{H}=10$	$\mathfrak{B}$ $\mathfrak{H}=100$	REMARKS.
25	13200	17320	Common refined iron.
5	12550	17300	
40	12800	17000	
37	13200	17450	Sample cut from the forging of small motor fields.

*Described in the *Electrical World*, Vol. 30, page 607, Dec. 11, 1897.

curve at the start; from the data furnished by the maker this poor quality is supposedly due to an excess of sulphur. It serves to show that the metal which works the best in the lathe and has apparently the finest structure is not always the best magnetically.

No. 2 is known by the makers as "Semi-Steel." The metal is very uniform, is tougher than cast iron and more brittle than cast steel. At densities up to 4 or 5 kilo-gausses it compares favorably with the best wrought iron or cast steel tested. Although it has a lower saturation point than cast steel, unlike cast iron, it reaches that point in a

TABLE III.

Cast Steel.

No.	$\mathfrak{H}$=10	$\mathfrak{H}$=100	REMARKS.
41	13200	17500	Unannealed "Dynamo Steel," 0.12% Car.
38	12600	....	Sample cut from pole casting.
36	14250	18000	Special "Dynamo Steel," Car. .11%, Man. less than .05%, Silicon .02%.
35	12100	18300	Curve by Ewing, metal same as No. 36.
33	11150	17400	Common machinery steel, Car. .21%, Man. .61%, Silicon .2%, Phosphorus .04%.
26	6400	17550	Metal rich in sulphur. Curve too low for low values of $\mathfrak{H}$
10	10000	17400	Unannealed cast steel.
4	10000	17000	
21	11600	17700	Open hearth steel.
2	8000	12500	"Semi-Steel," quality very uniform, very good for low densities.

finely rounded curve, making it greatly superior to cast iron and very well adapted to use in field frames and yokes where the density is usually low.

Some 40 samples of sheet iron and sheet steel were tested and with widely varying results. In cases where a sufficient amount of one kind of metal was received, samples of it were treated in different ways and then tested; in some cases where only enough for one sample was furnished, this was tested as it came from the maker, then treated in a manner desired and tested again. One mode of treatment was to place the metal in an open furnace for from 36 to 50 hours, no attempt being made to exclude the air or to keep the iron at

TABLE IV.

Laminated Metal.

No.	$\mathfrak{B}$ $\mathfrak{H}$=10	$\mathfrak{B}$ $\mathfrak{H}$=100	$\mathfrak{B}$ $\mathfrak{H}$=450	REMARKS.
34	13350	17150	21150	Sheet steel, specimen annealed in air-tight compartment.
23	12150	16850	20850	Same as 34 but unannealed.
15	11900	16420	20600	Same as 23 and 34 but annealed in open air.
9	13400	17650	....	Sheet steel unannealed.
17	12800	17170	....	Same as No. 9 but annealed in open air.
8	9800	16400	....	Same as Nos. 9 and 17.
29	13350	18000	21420	Sheet steel unannealed, cut from armature punching.
0	13350	17880	21700	Sheet steel annealed in open air fire.
31	11950	16440	19400	Unannealed sheet steel.
3	11700	15750	19450	Same as 31 but annealed in an air-tight compartment.
44	12500	17000	20600	Same as 31 but annealed in open air fire.
6	14100	18200	22100	The best specimen. Same as 29 but annealed in air-tight compt.
22	14000	17840	21550	Unannealed.
16	15000	18040	21620	Same as 22 but annealed in air-tight compartment.
30	13300	17250	21000	Same as 16 and 22 but annealed in open air fire.
45	12800	17100	20800	Transformer iron.
24	10800	15260	19300	Sheet iron.
11	12700	16950	20850	Sheet steel (same company).
14	9900	14850	18800	Sheet iron (same company).
7	11200	15400	19900	Sheet steel (same company).
19	12250	17340	20800	Armature iron.

a constant temperature. In all cases but one this treatment produced, to a greater or less degree, a diminution in the density for any given value of magnetizing force. Other specimens were heated for an equivalent length of time in an air-tight compartment, not allowing the metal to come in contact with the combustible materials, and in all but one case the permeability was visibly increased. The best specimen tested was a sample of sheet steel which had been treated in this manner; it gave $\mathfrak{B}$ = 14,100 gausses at $\mathfrak{H}$ = 10, 18,200 gauses at $\mathfrak{H}$ = 100 and 22,100 gausses at $\mathfrak{H}$ = 450. The poorest piece was a sample of sheet iron in which $\mathfrak{B}$ = 9900 at 10 Gilberts, 14,850 at 100 and 18,800 at 450.

The variation of the quality of sheet metal proved to be no greater than was anticipated, but it is certainly beyond an allowable limit and shows the necessity of frequent tests to avoid the use of low grade iron. The curves on the best samples of each kind of material were run to a high value of $\mathfrak{H}$ and are plotted separately to show the relative densities of the different forms of iron. The sheet steel gives the highest values throughout, and the cast steel curve crosses that of the wrought iron at $\mathfrak{H}$ = about 45.

Reports of the tests have been furnished the manufacturers sending the samples, and in some cases the curves ran far below the quality guarantee upon which the iron was purchased.

The Revision of the National Electrical Code.

The meeting of the Underwriters' National Electric Association, which was held last week in New York for the purpose of deciding upon the 1901 Electrical Code, was largely attended by experts from both the electrical and insurance fields. Some important alterations and additions were made in the present code, now two years old, those of the greatest interest having been mentioned in these columns last week. As then stated, the proceedings showed a general tendency to leave open two or more alternate courses, notably in the cases of the grounding of low potential circuits, and the slow-burning, weatherproof insulation of wire. Exhaustive reports were made by many of the sub-committees, appointed for the purpose of investigating the special subjects upon which action was to be taken, and their submission was followed by discussions of marked thoroughness. Some of these committees were reappointed in order that they might continue their investigation until the meeting of next year.

In preparing a code of this kind the value of the work depends upon the personnel of the attendance. Below is given a partial list of the fifty or sixty members and manufacturing representatives who were present, and a glance at the names will at once indicate upon what good authority the actions of the committee are founded. The Electrical Committee of the Underwriters' National Electric Association consists of F. E. Cabot, chairman; C. M. Goddard, secretary; W. A. Anderson, A. E. Braddell, H. C. Eddy, E. A. Fitzgerald, J. C. Forsyth, E. V. French, W. H. Merrill, Jr., William McDevitt, and A. M. Shoen; and with the exception of Mr. Eddy it was represented by all its members. Some of the other attendants at the meeting from insurance companies and the inspection departments of municipalities were: F. M. Griswold, J. E. Cole, E. L. Heselton, H. G. Winsor, E. N. Davis, H. S. Wynkoop, C. F. Boynton, R. Sweetland, G. W. Wilson, G. E. Bruen, J. D. Nolan, W. T. Benallack, E. N. Dexter, H. P. James, and H. O. Lacount. The American Institute of Electrical Engineers was represented by A. E. Kennelly, J. W. Lieb, Jr., and H. A. Sinclair officially. Among the representatives of manufacturing companies and other electrical men were: Prof. W. L. Puffer, of the Massachusetts Institute of Technology; C. E. Skinner, of the Westinghouse Electric and Manufacturing Company; H. C. Wirt, of the General Electric Company; C. C. Chesney, of the Stanley Electric Manufacturing Company; Arthur Williams, General Inspector of the New York Edison Illuminating Company, and C. J. H. Woodbury, Assistant Engineer of the American Telephone and Telegraph (Bell) Company, of Boston, and Prof. Henry Morton, of Stevens Institute.

Prof. Puffer, as chairman of the sub-committee on "The Carrying Capacity of Aluminum Wire" submitted a table, given herewith, showing the relative safe currents for aluminum and copper wires of various sizes, both covered and bare. The figures for aluminum were calculated graphically from the results of a great number of tests made on different sizes of aluminum wire, the part of the table referring to copper being taken from that already published in the code. Considering the present impracticability of using aluminum wire for interior work, however, and the fact that the figures showed a percentage relation, it was decided to merely state this percentage. A note to the present table for copper wire will, therefore, be added, to the effect that covered aluminum wire has 84 per cent the carrying capacity of covered copper wire and bare aluminum 77 per cent of bare copper. It will be noticed from the column headed "Smoking Copper" that copper wire becomes hot enough to smoke when carrying about three times its safe current. Prof. Puffer also made a report on automatic rheostats in which he pointed out large room for improvement and advocated the adoption of severer tests by the manufacturers.

A great number of break-down and short-circuit tests have been made on fuses during the year and many exhibits were made of fuse blocks that had been rendered unsafe by the blowing of the fuses. The mica-covered cut-out was strongly condemned as a fire hazard. The difficulties in getting a fuse block which could not be improperly fused were discussed, and it was the general opinion of the speakers that some form of enclosed fuse was the nearest approach to the

solution of this problem. For small currents, some form of plug cut-out, similar to the familiar lamp socket fuse plugs of the General Electric Company, were recommended. The spacing of break distances in switches and fuse blocks gave rise to some discussion. As they stand in the code at present the required distances for fuses is considerably less than for switches. After quite a little altercation, they were allowed to stand as now printed. In view of the numerous fires which have recently occurred on the elevated and other roads from defective car wiring, a subject to which the committee has given

Size.	Rubber Covered			Weatherproof		Bare
	Copper.	Aluminum.	Smoking Copper.	Copper.	Aluminum.	Aluminum.
2,000,000	1050	880	3340	1670	1400	1290
1,900,000	1010	850	3220	1610	1350	1240
1,800,000	970	815	3100	1550	1300	1190
1,700,000	930	780	2980	1490	1250	1150
1,600,000	890	745	2860	1430	1200	1100
1,500,000	850	715	2720	1360	1140	1050
1,400,000	810	680	2560	1290	1080	1000
1,300,000	770	640	2440	1220	1020	940
1,200,000	730	610	2300	1150	970	890
1,100,000	690	580	2160	1080	910	830
1,000,000	650	550	2000	1000	840	770
900,000	600	500	1840	920	770	710
800,000	550	460	1680	840	700	645
700,000	500	425	1520	760	640	585
600,000	450	378	1360	680	570	525
500,000	390	328	1180	590	500	455
400,000	330	275	1000	500	420	385
300,000	270	226	800	400	340	310
200,000	200	168	600	300	250	230
0000 B&S	210	176	605	312	264	233
000	177	149	515	262	220	200
00	150	126	440	220	185	168
0	127	107	380	185	155	141
1	107	90	325	156	131	119
2	90	76	285	131	110	100
3	76	64	245	110	94	85
4	65	55	210	92	79	72
5	54	45	180	77	65	59
6	46	39	155	65	54	49
8	33	28	118	46	38	35
10	24	20	85	32	27	25
12	17	14	65	23	19	18
14	12	10	48	16	13	12

PROPOSED ALUMINUM WIRE TABLES.

but little attention in the past, a sub-committee thereon was appointed.

Some of the more important sub-committees which either reported at the meeting this year, or were appointed at that meeting for future reports, are as follows: Grounding Low Potential Circuits, E. V. French and C. M. Goddard; Slow-Burning Weatherproof Wire, E. V. French, A. E. Braddell and J. C. Forsyth; Carrying Capacity of Aluminum Wire, Prof. W. L. Puffer, E. A. Fitzgerald and Ralph Sweetland; Automatic Rheostats, E. V. French, Ralph Sweetland, A. E. Braddell and Prof. W. L. Puffer; Rules for Marine Wiring, Ralph Sweetland and W. T. Benallack; Cut-out Spacings and Requirements, E. V. French, J. E. Cole and W. H. Merrill; High Potential Motors, A. M. Schoen, H. O. Lacount and Ralph Sweetland; Wiring for Trolley Cars, J. C. Forsyth, H. S. Wynkoop and William McDevitt; Flexible Cables for Elevator Work, J. C. Forsyth, H. O. Lacount and L. J. Myers; Destruction of Underground Metal Work by Electrolysis, A. M. Schoen, Prof. W. L. Puffer and George H. Spooner.

Street Railways in the Lighting Field.

A special despatch from Boston says that the action of the Lynn & Boston, Brockton Street Railway, Globe Street Railway and Lowell, Lawrence & Haverhill Street Railway Companies, owned by the Massachusetts Electric Companies, in applying to the legislature for authority to generate electricity and sell same, has created consternation among the electric lighting interests in the State. The Massachusetts Electric Companies owns two electric lighting companies, the Hyde Park Electric Company and the Newport Electric Company. Legislation is asked for to consolidate the former company with the Brockton street railway system; the latter will probably go into the Globe Street Railway system of roads.

Should the companies secure legislation which will enable them to sell electricity, it would open a wide field for the Massachusetts Electric Companies. Its roads go through about 100 cities and towns in Massachusetts and Rhode Island, and it necessarily has surplus electricity which it could dispose of advantageously either by selling to the companies now in the field or direct to the consuming public for power and lighting purposes. The following statement has been given out by the Massachusetts Electric Lighting Association: "In answer to inquiries as to the attitude to be assumed by the association toward the petitions of several large street railway companies recently published, which, upon their face, seem to look towards a possibly entry into the field of electric lighting or power by those companies, we are pleased to be able to say that we have received the most positive assurances from those in control of the companies referred to that they entertain no such purpose, and that their petitions for legislation are not intended to extend their powers outside of the field of the street railway business. These assurances are of such a character, and come from such sources that we are justified in the statement that no efforts to secure legislation antagonistic to electric lighting companies will be made by the street railway companies above referred to."

In this connection it may be mentioned that there are insurance rules against the operation of commercial lighting circuits from railway plants as follows: "Lighting and power from railway wires must not be permitted under any pretense in the same circuit with trolley wires with a ground return * * * * nor shall the same dynamo be used for both purposes."

Exports of Manufactured Metals.

An illustration of the rapid growth of our manufacturing interests is found in the fact that the exportation of manufactures of metals during the year about to end will reach $200,000,000. The figures of the Treasury Bureau of Statistics for the ten months ending Nov. 1 show that more than $100,000,000 worth of iron and steel and more than $50,000,000 worth of copper had been exported during the ten months, and these figures, coupled with those relating to the less important manufacturing metals and the articles manufactured from metals, but not included under these general terms, will bring the total for the year up to fully $200,000,000. In steel rails the exports of the year will aggregate $12,000,000, or an average of a million dollars per month, while it was not until 1897 that the figures for any entire year reached as much as $1,000,000. In the fiscal year 1890 the total value of steel rails exported was $315,000; in 1896 it was only $540,000; in 1897, $2,500,000; in 1898, $4,500,000; in the fiscal year 1899, $5,250,000, and in the calendar year 1900 will be fully $12,000,000. Nearly one million dollars' worth of these exports of steel rails in 1900 go to Europe; another million dollars' worth to Mexico; nearly two millions to South America; four millions to British North America, and two million dollars' worth to Asia and Oceania. American locomotives also go along with the American steel rails, and the total for the year seems likely to reach about five million dollars in value. The American rails and locomotives are in turn accompanied by American cars, of which the exportation for steam railways will amount to three million dollars during the year, and for other railways more than a million dollars. Add to this a proper share of the $6,000,000 worth of electrical machinery and $6,000,000 worth of telegraph, telephone and other electrical instruments and scientific apparatus exported, and it will be seen that for the construction and operation of railways outside of the United States the manufacturers of this country will supply during the year about to end fully $25,000,000 worth of material.

The rapid growth in the exportation of metals and those of which metals form a large proportion in value is illustrated by some figures regarding our export trade of the decade. Manufactures of brass, for instance, of which the exports in 1890 amounted to $467,313, were in the fiscal year 1900, $1,866,727. Agricultural implements, including plows, cultivators, mowers, reapers and other machinery of this character, amounted in 1890 to $3,859,184, and in the fiscal year 1900 to $16,094,886. Pig iron exports in 1890 amounted to only 18,458 tons valued at $300,832, while in the fiscal year 1900 they amounted to 160,690 tons valued at $3,124,853. The bar iron exportations in 1890 amounted to 2,087,376 pounds and in the fiscal year 1900 to 18,457,435 pounds. Wire exportation in 1890 amounted to 21,529,962 pounds and in 1900 amounted to 236,872,806 pounds, the average exportation for each month in 1900 being thus nearly equal to the annual exportations in 1890. In nails the exportations in 1890 amounted in round terms to 15,000,000 pounds, and in 1900 to 113,862,461 pounds. The total iron and steel exports in 1890 amounted to $25,542,208 and in the fiscal year 1900 to $121,858,344, and in the calendar year 1900 will reach $140,000,000 in value.

In copper the growth in exportations has been equally striking, the total exportation of copper in the fiscal year 1890 being $2,349,392 in value and in the fiscal year 1900, $57,851,707, while in the calendar year 1900 it seems likely to considerably exceed $60,000,000.

Niagara Power to Shred Wheat.

Niagara Falls has been selected as the location for the mammoth new plant of the Natural Food Company, incorporated in Albany on Friday, Dec. 14, with a capital stock of $10,000,000. This company will control the business of the Shredded Wheat Company, now located in Worcester, Mass., and the business will be transferred to Niagara Falls. The property purchased at Niagara for this new plant is right in the heart of the finest residence section of the city. It is located on the upper river, adjoining the State Reservation, and included in it are the residences of William B. Rankine, vice-president of the Niagara Falls Power Company, and Hon. Peter A. Porter, together with considerable property of similar value. Buffalo avenue runs through two plots selected, and on one side of the avenue will be erected the Oread Institute of Domestic Science and Art, and on the other the Conservatory of Natural Food Products, or factory. The expenditure on the buildings will be over three-quarters of a million dollars. The plans have been made, and the contracts let to Norcross Brothers, of Worcester, Mass. Ground was broken on Dec. 14, in front of Mr. W. B. Rankine's home, which is now the property of the company. The buildings will be of magnificent size, and built of enamelled brick, steel and glass. They will be from five to six stories high, and cover a total area of 65,101 square feet, which includes a boiler house and grain elevators and grain cleaning buildings. On the roof there will be a roof garden overlooking the upper Niagara. It is hoped to have the plant in operation by May 1, 1901. Within a year 1,000 hands will be employed, principally skilled labor. Electric power will be used in operating the plant, the current to be supplied by the Niagara Falls Power Company. However, in this case, it was not merely the cheap, clean power of Niagara that primarily induced the Natural Food Company to locate there. On the contrary, it was the desirable center between the consuming sections of the country.

The president of the Natural Food Company is Henry D. Perky, now of Niagara Falls. Mr. Perky is the inventor of the shredded whole wheat biscuit, and he will be treasurer of the company also On the directorate appear the names of William B. Rankine, vice-president of the Niagara Falls Power Company; Edward A. Deeds, of Dayton, O., and Ira C. Hubbell, president of the Locomotive Appliance Company of Chicago. Mr. Deeds will be the company's engineer.

CURRENT NEWS AND NOTES.

PARIS EXPOSITION LOSS.—The official report of the finances of the Exposition shows a loss of 2,000,000f. ($400,000.) The total of expenditures is 116,500,000f. ($23,300,000.) The receipts amounted to 114,500,000f. ($22,900,000.) The loss is less than in any of the preceding expositions.

MICHIGAN TAXATION.—By a vote of 69 to 13, the Michigan House of Representatives has passed a blanket advalorem tax bill, providing for the taxation of railroads, express companies and telephone and telegraph companies upon the cash value of their property, instead of specifically upon their earnings, as the present law provides.

BAD FIRE IN CLEVELAND.—A fire, entailing a loss of $400,000, occurred on Monday at the works of the Elwell-Parker Electric Company and Brown Hoisting & Machine Company, Cleveland. The loss is fully covered by insurance, but the fire involves considerable delay in the delivery of important orders. It is said that the fire broke out in the paint room of the Elwell-Parker shops into which an employee went with a lighted candle to get some supplies.

A LARGE CANADIAN GENERATOR.—The Cataract Power Company at De Cew Falls, Ont., has just completed the installation in its power house of one of the largest electric generators for light and power purpose built in Canada. The generator has a capacity of 2,000 kilowatts with a large overload capacity. The weight of this generator, complete, is over 110 tons, or 220,000 lbs., and is similar in design to the 1,000-kw machine, two of which the Cataract Company now has in its power station. The capacity of the Cataract Power Company's electric plant is now over 10,000 horse-power and its station is one of the most complete in Canada. The two lines from De Cew Falls to Hamilton, Ont., a distance of thirty-five miles, are now in daily successful operation.

MUNICIPAL LIGHTING IN OTTAWA.—The City of Ottawa, at the last election, voted in favor of municipal ownership and operation of an electric light plant. The special committee, appointed by the city council to report upon the feasibility of purchasing a municipal electric plant from the Ottawa Electric Company, has advised that no action be taken at present because of the terms which that company demands. It is recommended that the city apply to the Ontario Legislature for such an amendment to the existing laws as will enable the city to arbitrate in its efforts to get a civic lighting plant, it being now debarred by the statute from so doing when a contract, as in the present instance, is still in force between a municipality and an electric company.

STEAM ENGINE ECONOMY GUARANTEES.—In a paper read before the recent meeting of the Steam Engine Builders' Association of the United States, Mr. E. J. Armstrong expressed the opinion that the proper place to test an engine is on the shop testing floor, where the work can be done in a short time and at little cost. When a penalty is provided for non-fulfillment of an economy guarantee and the engine is tested, Mr. Armstrong recommends that an addition to the price be required. He recommends that all duty guarantees should provide for their determination by shop floor tests before shipment and should always be considered as an extra, it being optional for a purchaser to accept a proposal with or without the guarantee If a guarantee does not mean anything, he added, it should not be made; if it does stand for something, it costs a good deal and is worth to the customer all that he is likely to be asked for it.

A POLYPHASE DINNER.—The testing department of the General Electric Company held a notable dinner at Stanwix Hall, Albany, on Saturday evening, Dec. 8. About 150 men, representing 60 colleges, 27 states and 14 nations, were present. Mr. E. D. Raymond and Mr. A. L. Rohrer were the guests of the evening. The dinner was most successfully presided over by Mr. W. P. Cochran. Speeches were made by Messrs. Raymond, Rohrer, Morrow, Jones, Proud, Kehrer, Siki, Ito, Stone, Dodge, Smith, Reed, Atnesta, Beenwkes and Wallace. A double quartette from the testing department sang several times. Mr. W. W. Ray made a great hit with an original topical song. Music was furnished throughout the evening by an orchestra. The unusual number of different college yells heard after the dinner was a remarkable feature. The affair was in charge of the Messrs. J. R. C. Armstrong, Harold Edwards, Percival H. Lombard, Randolph M. Mann and Fred L. Reed.

MOVING SIDEWALK FOR PARIS.—The Paris *Figaro* states that a project exists for constructing a moving electrical platform on the right bank of the Seine. It will be underground and its length will be about 10 kilometers. The route proposed passes under the Avenue de l'Opéra, the great boulevards, the Boulevard Sébastopol, the Rue Turbigo and the Rue de Rivoli. In place of the three platforms now existing at the Exposition, the new scheme embraces four. The first, as at the Exposition, will be stationary, the second will have a velocity of 1.50 meters the second, the third 3 meters and the fourth 5 meters. Thus a very rapid means of transit afoot will exist in that portion of Paris now most encumbered by vehicular traffic, for, as all locomotion will be in one direction, a persons walking fast on the fourth platform, having no adverse stream of pedestrians to avoid, will easily be able to do more than ten miles an hour. An actual necessity exists for an improved method of locomotion.

INTERNATIONAL PATENTS.—The International Conference sitting in Brussels for the Protection of Industrial Property, at which United States Assistant Patent Commissioner Walter H. Chamberlin and Lawrence Townsend, United States Minister to Belgium, were the American representatives, adopted the following resolutions: First—The period of exclusive rights, previously fixed at six months for [applications for] patents and three months for industrial designs, models, and trade marks, is extended to a year for the first named and four months for the second named. Second—Countries signing the convention enjoy reciprocally the protection accorded by each country to its own citizens against unfair competition. Third—Patents cannot lapse because they are not put in circulation, except after a minimum delay of three years, dating from the first application in countries where the patent is allowed and in cases in which the conditions of the patent do not justify causes of inaction.

DETECTIVE ROENTGEN RAYS.—The postal authorities of the Argentine Republic have recently used the Roentgen ray to detect jewelry smuggled in big parcels sent through the post. Eighty parcels, it is said, were thus detected recently.

VANDERBILT ESTATE.—The official schedule just published of the personal estate of the late Cornelius Vanderbilt shows a total valuation of $53,000,000. Apparently Mr. Vanderbilt took very little interest of any kind in electrical development. The only "electrical" securities in the list are Brooklyn street railway bonds and stocks amounting to about $850,000.

TELEGRAPH LINE IN THE YUKON.—Advices from Alaska state that Eagle City, on the American Yukon, was connected by telegraph with Dawson City on Oct. 20, giving through service from Eagle to Skaguay. The same system is also extended south to Atlin. Eagle is the first town on the American side of the boundary, and is about 100 miles from Dawson.

SUBSTITUTE FOR GUTTA-PERCHA.—A patent granted Dec. 11 to Salomon Heimann, describes a substitute for gutta-percha, consisting of a mixture of pulverized peat and resin oil. The peat is first dried thoroughly and then pulverized and sifted until it is of about the fineness of flour; it is then mixed with equal parts by weight of resin oil and 2 per cent of amyl acetate. The mixture is stirred and worked until it is of about the consistency of dough, when it is worked into suitable blocks or strips, and while drying assumes a semi-hardness like ordinary gutta-percha.

MAXIMUM DEMAND METER.—A patent granted to Eustace Oxley, describes a maximum demand meter based upon the disturbance of the hydrostatic balance of a liquid by the influence of a magnetic field. The reservoir of liquid is within the influence of a magnetic field and provided with terminal electrodes in contact with the liquid. When the current is passed through the electrodes, the mutual repulsive action of the electrostatic and magnetic fields created by the magnet and by the current respectively, acts as a pump and causes the level of the liquid to be changed in a tube dipping into the reservoir, the level being raised in propertion to the strength of the current passing. The pumping action will continue until the propelling force determined by the electrostatic and the magnetic fields is balanced by the hydrostatic pressure due to the difference in level between the liquid in the reservoir and that in the tube. Means are provided for leaving an indication of the maximum disturbance of level. A time factor is added whereby the level of the liquid is disturbed in a slow manner.

STORAGE BATTERY CONNECTION FOR RAILWAY SERVICE.—It has been assumed that a storage battery may be connected in the usual way across the two bus-bars of a railway circuit to provide for fluctuating loads. In a patent granted Dec. 11 to Henry R. Kent it is stated that in practice it has been found that with this connection when the load becomes excessive, the dynamos fail to take their share of the load, in consequence of which the load thrown on the battery may be sufficient to endanger its life. To obviate this Mr. Kent, in the case of two or more generators in parallel, supplies a third bus-bar, and connects the battery between this and the line bus-bar; the shunt coils of the generators are similarly connected, while the series coils are connected between the extra bus-bar and the earth bar. By this means all of the line current, whether supplied by dynamo or by battery, must traverse the field windings, and thus serve at all times to hold the machines up to their work. With the usual arrangement the battery current would not traverse the field windings, and thus fail to do their work, as above noted.

STEERING SUBMARINE CRAFT.—A cable dispatch from London, of Dec. 15, says: "The British Admiralty has thoroughly wakened up to the importance of submarine and similar methods of warfare. It has arranged to test an invention for steering torpedoes and submarine boats by means of the system of wireless telegraphy operated by Alfred C. Higgs, the United States Consul at Weymouth. The United States Naval Attaché, Commander Clover, is following up the matter closely. Germany has made an offer for the German rights. The invention has been considerably altered since it was first shown to the German Government. The inventor now expresses the belief that the danger of interference, or 'jamming,' as it is technically called, has been eliminated. As recent Marconi experiments prove, instruments not exactly tuned to the same note can have no influence over others, regardless of the power of the batteries. Mr. Higgs provides each torpedo with a different note and directs it from a ship or the land, or under water, toward the object it is desired to destroy, by means of the same current whereby wireless messages are transmitted."

SELECTIVE TELEPHONIC SIGNALING.—In a patent granted Dec. 11, to F. A. Pickernell, a selective signal system is described for use in connection with calling apparatus for party-line telephone circuits; the object being to provide a selective signal system adapted for use in connection with metallic telephone circuits of the central battery type extending between a central station and four sub-stations. Four signal transmitting keys at the central station corresponding to the four party connections, are adapted to simultaneously transmit an alternating current over one or the other of the two main conductors for the operation of relays connected therewith; and pulsatory or intermittent current of appropriate direction over the other main conductor to ring the desired one of two bells brought into connection therewith by the operation of the relays. The station bells are adapted to respond to pulsatory currents of a plus and minus sign respectively. When one pair of relays acts, a bell at one of two sub-stations connected will be responsive to a plus pulsatory current, the other bell not responding; and when the other two relays are closed by an alternating current over the other line, the same condition applies to the third and fourth bell.

ELECTROLYTE ARC ELECTRODES.—A patent issued Dec. 11 to Ewald Rasch, of Nuremberg, Germany, relates to a system of arc lights based upon the use of electrodes of the oxides of rare earth metals. In reviewing the relation between radiation and temperature with respect to this material, it is stated that when Nernst lamps are marked at 1.5 watts a "double efficiency of 10 per cent in the light emission may be expected as compared with carbon incandescent light." If, however, the rare earths can be utilized at a still higher temperature, a greater economy can be obtained, and if between fixed electrolyte electrodes a permanent arc be established, the expenditure of energy will amount to only about .25 watt per candle. The claims of the patent are on a method of producing light which consists in bringing into arcing proximity electrodes which are conductive when heated and non-conductive when cold; heating the electrodes to contact temperature by external heating means, and establishing and maintaining an arc by a flow of current between the electrodes. Other claims are on an electrode in which the metallic oxide is provided with a jacket or core of a better conducting material, such as carbon.

SHAFTING OF DIRECT CONNECTED GENERATORS.—In a paper read before the recent meeting of the Steam Engine Builders' Association of the United States, Mr. H. C. Ebert gave the following as the practice of the Westinghouse Company with respect to the electrical portion of a direct connected unit: "Up to and including 125-kw, 200 r. p. m. generators, simply the bare machine is furnished; that is, the fields and armature without shafting, shaft-key, out-board bearing, bed-plate, steel guide strip and holding-down bolts. With machines of larger capacities than 125 kilowatts, the bed-plate steel guide strip and holding-down bolts are supplied, as usually the larger sizes cannot have a common sub-base with the engine. With respect to shafting, it was stated that armature spiders are arranged to receive a shaft amply large for extreme rigidity, it being absolutely necessary for the armature to run perfectly central in the fields to prevent unbalanced magnetic poles. Shafts are figured for both deflection and fibre stress, taking into account the possible unbalanced magnetic pull. In submitting generator drawings to engine builders, attention is called to this magnetic action if the armature becomes decentralized, and the amount of magnetic pull which may be expected of the generator is stated on the drawings. As this unbalanced magnetic pull acts at right angles to the shaft and may be in any direction to the plane of revolution, it should be carefully considered, not only for the shaft diameter but also for the strength of the foundation, sub-base and bearing housings. The connections between the out-board bearings and the sub-base should be perfectly rigid. In one or two instances where this magnetic action was not taken into consideration by the engine contractor, the almost total destruction of both engines and generators resulted."

LETTERS TO THE EDITORS.

Compound Dynamo as a Motor.

To the Editors of Electrical World and Engineer:

Sirs:—It sometimes comes convenient in the handling of an electric plant to utilize one of the dynamos as a motor. This may be to supply power, to run another dynamo, or shafting to which are connected mechanical devices, to aid in the running of the plant. A point of interest was presented to the writer when handling a plant under the following conditions:

A section of shaft running two dynamos, one an arc, the other a compound machine of 40-kw capacity, was connected to the engine by a friction clutch. When it was not desirable to run this engine for the arc lights, the compound dynamo was made to do the work by running it as a motor. In doing this it was found that as soon as the dynamo ceased to generate a current and began taking current from the other dynamos, or a dynamo, which were also compounded, a most decided drop in voltage took place.

It was noticed that the drop was in excess of that of a shunt motor using the same amount of current. Carrying an experiment further by giving the generating dynamos more of a load through the one running as a motor, a drop was obtained that amounted to fifteen and even twenty volts. That this drop does not come through overload, or drop of speed of engine is known.

What is the cause of this excessive drop in voltage? The writer would like to know if this matter has presented itself to others, who have the operating of compound dynamos?

Rochester, N. Y. J. T. Freeman.

Deposit of Carbon on Welsbach Mantles.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to the final paragraph in the section of Dr. Bell's serial on the "Elements of Illumination" which appears in your issue of Nov. 24, I would offer the following corrections:

1. The cause of the carbon deposit on Welsbach mantles is too much gas for the air supply. The remedy is to regulate the shutter to supply the proper mixture, and then to "pinch" it so that it cannot be accidentally changed.

2. To burn off the carbon deposit the gas supply should be *decreased* or the air supply *increased,* instead of the reverse, as recommended by Dr. Bell.

3. The least unsteadiness of the gas pressure causes the light to flicker, notwithstanding the assertion of Dr. Bell to the contrary.

East Orange, N. J. J. H. Watson.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Design of Transformers.—Routin.—A very long paper, read before the Internat. Elec. Congress, on the design of transformers. It is mainly of a mathematical character. When designing a transformer, one has to choose the cross-section of the core, its height, the distance between two cores, the value of the magnetic induction, and the weight of copper; all these values are independent of one another, except that the condition must be fulfilled that the height of the cores and their interspace must allow enough space for the windings. He first develops a theorem which enables one to find the most economical distribution of the copper between the primaries and secondaries; in general it is not correct to make the losses in the primary and in the secondary equal. He then discusses the following question: If the frame of a magnetic circuit is of given dimensions and of an invariable total weight of copper, what are the effects of the variation of the induction upon the general conditions of operation, such as no load loss, voltage drop, efficiency and heating of the different parts? He shows that the best arrangement in practice does not correspond to the theoretical conditions of maximum efficiency. He gives a relation between the height and interspace of the cores, corresponding to the minimum of hysteresis loss. He discusses the influence of the variations of the dimensions of the magnetic circuit; also that of the variations of the section of the cores. He then determines the most economical form of the cross-section. The transformers designed by him for Grammont are described.—*L'Eclairage Elec.,* Nov. 10.

Induction Motors as Generators.—Leblanc.—The conclusion of his illustrated paper, noticed in the Digest Nov. 3 and Dec. 1. A simple method of generating the e. m. fs. of lower frequency that must be developed between the ends of the secondary circuits is to use ordinary direct-current machines, furnished with commutators, whose field magnets are excited by alternating currents of any convenient frequency. There are therefore added to each generator two small direct-current dynamos exactly alike. Each of the two secondary circuits is connected with one of the armatures of these machines.—Lond. *Elec. Rev.,* Nov. 30.

Direct-Current Motor.—Martin.—A brief mathematical article on the variation of the speed of a direct-current motor at constant voltage and varying magnetic field. It is correct to say that the speed is inversely proportional with the magnetic flux, but it is necessary to add that this applies to starting from a certain value of the flux, and depends upon the construction of the motor and the conditions under which it is used.—*L'Elec.,* Nov. 3.

Danger Signal for Dynamos.—Aliamet.—An illustrated description of a device of Bright for dynamos and motors, especially tramway motors, to signalize when, on account of the wear of the bearings, the armature ceases to remain concentric with the field, so that there is danger of mechanical friction between the armature and the lower pole pieces. Midway between the two lowest pole pieces a brush is placed so that its distance from the armature is smaller than the distance between the pole surfaces and the armature. When the armature touches this brush a circuit is closed containing a battery and an electric bell, and the bell rings.—*L'Elec.,* Nov. 10.

REFERENCES.

Synchronous Converters.—Perkins.—The first part of an illustrated article on "Rotary converters and motor-generators." The following cases are briefly discussed: A synchronous converter is supplied with alternating current and is used as motor and as direct-current generator combined. A synchronous converter is supplied with direct current and is used as motor and alternating-current generator combined; in this case the speed of the converter does not remain constant; it is often supplied with a special exciter. A synchronous converter, when driven by any prime mover, can be used as direct-current generator, or as alternating-current generator, or as double-current generator. A converter can be used for converting direct into alternating or alternating into direct current or for converting in either direction. The synchronous converter is rapidly being introduced in mines; while alternating current is thoroughly practical for the incandescent lamps and the induction motors in the mines, direct current is wanted for the electric locomotives.—*West. Elec.,* Dec. 8.

E. M. F. of Alternators on Open Circuits.—Hawkins.—Continuation and conclusion of his paper, noticed in the Digest Nov. 17. After slotted armatures he discusses smooth surface armatures. The paper contains many diagrams and tables.—Lond. *Elec. Rev.,* Nov. 7 and 30.

Single-Phase Motors.—Wilmshurst.—A reprint in full of the British paper abstracted in the Digest July 21.—*West. Elec.,* Dec. 8.

Dividing the E. M. F. of Direct-Current Dynamos by Means of Induction Coils.—Sengel.—A very long illustrated French abstract of the German paper noticed in the Digest June 23.—*L'Eclairage Elec.,* Nov. 17.

Compound Dynamos.—Adams.—An article on "Series windings on compound dynamos and their adjustment." The article deals principally with the operation in parallel of compound dynamos. The subject is also discussed editorially—*Am. Elec.,* December.

Motor Repairing.—WEEKS.—An article giving some repair shop notes, and describing how to put a commutator in place and how to solder iron.—*Am. Elec.*, December.

Reducing Wear of Commutators and Bearings.—A description of a method of cutting out the mica between the segments and of boring babbitted bearings.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

LIGHTS AND LIGHTING.

Lighting with Electrolytic Hydrogen.—SCHMIDT.—In a paper on the electrolysis of water, noticed in another column, it is stated that by producing hydrogen electrolytically and burning it in a Welsbach burner, more light is obtained for the same amount of current than in the best Nernst lamps. In the discussion of the paper it is thought that the mantles would not last long under these conditions.—*Zeit. fuer Elektrochemie*, Nov. 15.

REFERENCES.

Control of Lights.—VAN VLEET.—An article on the "Control of lights from more than one point." He gives diagrams illustrating methods of wiring for two-point, three-point and four-point control. —*Am. Elec.*, December.

Incandescent Lamp Socket.—An illustrated description of the Brunt improved regulating incandescent lamp socket, which is a well-ventilated socket containing a rheostat by means of which any number of resistances can be thrown into the circuit to modify the light as desired.—*Sc. Amer.*, Dec. 8.

Train Lighting.—An editorial pointing out that in the choice of the best system of train lighting, safety to passengers, not cost, must be the principal consideration. Some historical and statistical notes are given on electric train lighting in England and Germany.—*Elek. Zeit.*, Nov. 22.

POWER.

Cost of Power.—VON MILLER.—A very long German Electrochemical Society paper on "The utilization of water power for electrochemical purposes." He first describes the general installation of a water power plant, and then gives long, comparative tables, which appear to have been prepared with great care for the first cost of installation and the cost of operation of a plant generating 6000 horsepower by five systems: plain water power plant; water power with steam reserve; steam plant; blast furnace gas plant. The tables are given in detail and the estimates appear to have been based upon reliable data. Some of the general conclusions are as follows: With a good water power available, even if the power must be transmitted some distance, the price of the hp-hour is cheaper, than with a steam or gas plant which can be used at the place. It is worth while to utilize not only the minimum amount of water, but the normal amount of water; not only when the manufacturer can accommodate himself to the varying amount of water, but also when a constant power is required so that steam reserve becomes necessary. Such a water power with steam reserve even with transmission over six miles is cheaper than steam power at the place, as long as the price of coal is over about $2.50 per ton. Blast furnace gas plants are well able to compete with steam plants. The discussion which followed is also given.—*Zeit. fuer Elektrochemie*, Oct. 11.

REFERENCES.

Electricity in Farming.—WALSH.—An article on the use of electric power for driving farm machinery, especially in the United States and Germany.—*Am. Elec.*, December.

Horse-Power.—A table giving the horse-power for direct current between ½ and 100 amperes at a voltage between 110 and 500.—*Am. Elec.*, December.

TRACTION.

Electric Automobiles.—Two communications referring to the recent British Automobile Club trials. Opperman complains about the very bad and hilly roads; future trials should be made under such conditions as can be carried out day after day without ruining the batteries; "for town use alone the field is wide enough, and to recommend their use for long country drives is a mistake; there are too many difficulties, especially with charging. Wade describes the controllers used on the Electric Motive Power Company's cars; to obviate the destructive sparking which usually occurs on breaking the main circuit when changing from one cell combination to another, the main current is not broken at all; this is accomplished by introducing a number of intermediate combinations through which the changes are effected, and so arranging the contact pieces that the circuit is always made on one before it is broken on another. Three intermediate stages are provided between each working combination; the first stage cuts some of the parallels; but leaves one or more in circuit to maintain the current; the second stage puts back into circuit in parallel with those still there, part or all of the cells cut out, but grouped in a different series according to the new e. m. f. it is desired to obtain; the third stage cuts out the remainder of the cells of the old grouping, and the contacts then pass on to the next working combination, where all the cells out of circuit are put back in parallel with those introduced at the second stage and in a similar series grouping. The description is in detail and illustrated by a diagram.—Lond. *Elec.*, Nov. 30.

Electric Automobile.—LUXENBERG.—A paper in which he discusses how to improve the mechanical efficiency of an electric automobile. Reduction of the weight of the vehicle by careful construction and lightest design, and the use of ball bearings, yield a reduction of 20 per cent of the energy consumed. The most effective means is, however, the increase of the diameter of the wheels; he recommends diameters between 3½ and 6 ft.; this gives an additional saving of 45 per cent of the energy of production.—*Centralblatt fuer Accum. und Elemkunde*, Nov. 1, 15; a long abstract in Lond. *Elec. Rev.*, Nov. 30.

Electric Traction on Main Lines.—LANGDON.—The first part of a Brit. Inst. Elec. Eng. paper "on the supersession of the steam by the electric locomotive." Whether this supersession will take place, is primarily a question of profit and loss. If the adoption of the electric locomotive enables railways to be worked more economically than with steam, it will be adopted. He gives in a table statistical data on British railways, showing the cost of locomotive power for Great Britain, including stationary engines for pumping and other purposes, to be 19.98 cents per train-mile. For a comparison of the electric and steam system he considers a 50-mile section between London and Bedford. He gives statistical data about this line and assumes for its electric operation a central station midway, generating three-phase currents at 100,000 volts, which is distributed to sub-stations, each serving 10 miles, where the current is converted to 600 and supplied to a contact rail. The total kilowatt to be generated would be 5000 and the combined efficiency 58.3 per cent. The paper is to be concluded.—Lond. *Elec., Elec. Eng.*, Nov. 30.

Electric Traction on Small Road.—An abstract of a paper read at the International Steam Railway Congress in Paris, describing tests made on an Italian road. In one plant alternating current is distributed from a central power station, to a line 109 k.m. in length, on which there is considerable traffic; the passenger trains will have a 300-hp motor car weighing about 50 tons, and carrying 60 passengers besides two tons of baggage and capable of drawing four ordinary cars at a speed of 60 k.m. per hour on grades of 1 per cent; the central generating station is operated by water power and there are 10 sub-stations; power is distributed at 20,000 volts and used on the trolley cars at 3000, thus involving the use of alternating-current motors, of which there are four on each car. The other line has four accumulator cars, each capable of running 106 k.m. without recharging; each car has 282 cells, with a capacity of 140 ampere-hours.—*St. R'y Jour.*, Nov. 24, and Int. Ed., December.

Italy.—A digest of a paper read before the International Street Railway Congress in Paris, describing the lines of an Italian railroad on which electricity was introduced in 1898. Trains of two cars are running, only one of which is a motor car and the speed is 90 k.m. per hour; water power and three-phase currents are used; there are 11 turbines and engines, each connected to a 750-kw generator; generation and distribution are at 12,000 volts reduced to 650 direct current at the sub-stations; the third rail is used; there are 20 motor cars.—*St. R'y Jour.*, Nov. 24, and Int. Ed., December.

Street Car Brake.—An illustrated description of the Newell electromagnetic brake for street cars. It consists of a horseshoe electromagnet suspended on spiral springs, so that the poles hang directly above the rails. When the magnet is excited, it forces down the poles, so that the shoes grip the rail in a similar manner to the ordinary track brake. The magnet is excited by current obtained from the motors acting as generators.—*Sc. Amer.*, Dec. 8.

Cast Welded Joints.—FISHER-DICK.—A paper read before the International Tramway Congress on the Falk joint, of which at least 21,400 are used in France and 7600 in Germany. The cost varies, and is said to be $3.12 in Havre, not including license and depreciation, and from $5 to $6 in Berlin; 75 to 100 joints can be cast in a night with one furnace. The breakages are said to be from 0 per cent in asphalt to 5 per cent in macadam; several companies quote ¼ per cent to ½ per cent. All the companies speak well of the joint when it is

installed with care; a disadvantage is the expense of casting a few joints.—*St. R'y Jour.*, Nov. 10; Int. Ed., December.

Wear on Rail Bonds.—BEYER.—Numerous illustrations showing the wear on fishplate and welded joints. He estimates the yearly cost of maintenance, and finds that the welded joint is 20.3 per cent more efficient than the fishplate joint.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Street Railroad Congress.—An abstract of the discussion at this Congress, on the subject of electric traction. After considerable discussion the Congress decided that while certain trials which are being made in Italy and Belgium, seem to indicate certain advantages of electric traction for light traffic and suburban lines, more data is desired. The advantage of electric traction for lines of heavy traffic have not yet been proved.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

REFERENCES.

Paris.—A very well illustrated description of the Metropolitan Underground Railway of Paris.—*Eng. News*, Dec. 6. (See ELECTRICAL WORLD AND ENGINEER, Aug. 11, 1900.)

Germany.—Interesting figures of various kinds concerning street railways in Europe, chiefly in Germany.—*St. R'y Jour.*, Int. Ed., December.

Italy.—An article on electric traction in Italy, stating that at present there are 3179 km. of street railway traction in Italy operated by mechanical traction, of which only 256 are operated electrically; many others are soon to use electricity. Many of the existing and proposed systems are described.—*St. R'y Jour.*, Nov. 24; Int. Ed., December.

Corea.—A description of the electric railroad at Seoul, which is the only one in that country. The alternating-current generators supply current for both lighting and the railway; the latter also carries freight.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

British Guiana.—A description of a new electric railroad being built in Demerara, of a capacity of 1300 horse-power.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Sicily.—PIC.—An article on the electric railway possibilities in that country, in which a line is projected about 300 km. in length operated by water power and high voltage alternating currents with rotaries.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Package Express Service in Pittsburg.—A description of the system of cars for carrying small packages and heavy freight in Pittsburg; each car averages 270 car miles per day.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Car House at Newark, N. J.—An illustrated description.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Repair Shop in Brooklyn.—A description of the new shops, which are said to be very fine examples of repair shop practice.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Railway Safety Regulations.—A commission has been formulating rules for the insulation on electric street railways, which are now being subjected to a year's trial, and if satisfactory will probably be made a law. The insulation resistance of overhead conductors must be at least 50,000 ohms per km.—*St. R'y Jour.*, Int. Ed., December.

Street Railway Operation.—Descriptions of three ingenious devices, one a trolley pole straightener, another for adjusting the sprockets of sweepers, and the third a sectional broom for snow sweepers.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Track Resistance.—BOOTH.—An article in which he advocates testing for track resistance under different conditions, by using a grade of about 1 to 1.25 per cent, which is just steep enough to allow the car to descend by gravity without requiring a brake. He gives formulas for finding the track resistance from the speed, together with some figures which he has obtained.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Narrow and Standard Gauges for Electric Roads.—GUNDERLOCH.—An article on their relative advantages.—*St. R'y Jour.*, Nov. 10 and Int. Ed., December.

Destruction by Railway Currents.—HERRICK.—A discussion of an accident to a standpipe in Peoria which had been claimed to have been due to electrolysis; the writer endeavors to show that railway currents could not have caused it.—*St. R'y Jour.*, Dec. 1; Int. Ed., December.

Shunt Wound Motors on Railway Circuits.—PARHAM.—An illustrated article discussing the reasons why when shunt-wound motors are used in car houses and repair shops to drive a line of shafting, the belt on the motor either slips or flies off, when a ground-out occurs on the line, and why series wound motors do not behave in this way.—*Am. Elec.*, December.

International Tramway Congress.—A summary of the proceedings with abstracts of the papers read, which were noticed in the Digest Nov. 24, Dec. 15.—*L'Eclairage Elec.*, Nov. 3.

Electricity in the German Navy.—GRAUERT.—A long, well-illustrated paper, read before the Union of German Electrical Engineers. In 1882 the first dynamos were installed on German battleships for the operation of searchlights with 35 amperes at 55 volts. Electric lighting on board ship was first introduced in 1887, the capacity of the first plant being 33 kilowatts for 225 lamps of 10-cp and two searchlights. He compares this with one of the newest installations, that of the Fuerst Bismarck, which has a plant of 325 kilowatts for 900 lamps, 44 motors of together 150 kilowatts, five searchlights of together 90 kilowatts, and several signal lamps and telegraph and telephone apparatus. He describes the different signal lamps which are now in use. Electric power is used for driving the ventilators and for hoisting. Guns up to a calibre of 15 cm are operated by electric power; heavier guns are operated by hydraulic means. The steering apparatus is not operated electrically. He discusses briefly the different telegraph and signal systems which have been used; it seems that those of Siemens & Halske (Digest, Oct. 7, 1899) and those of the Union Electric Company have found most favor; in the latter system the receivers are voltmeters of precision and the sending apparatus are rheostats. The revolving field system of dial signals of the General Electric Company of Berlin had in earlier experiments the drawback that no sufficient damping could be obtained; in the newer form of this system this drawback seems to have been overcome (Digest, Aug. 18). In the imperial yards at Kiel, trials are being made with an electric boat which is supplied with an 18-hp motor and a storage battery giving 390 or 325 ampere-hours, if discharged in six or three hours, respectively. Direct current is used throughout, on account of the searchlights. The voltage used is 120 or 110, or in the newer ships 74 to 65; the latter voltage has been chosen, because the searchlights are operated at 59 to 61 volts. In the earlier installations compound dynamos were used throughout, but now shunt wound dynamos are used on account of being easier to connect in parallel. On some of the newer battleships storage batteries have been installed, for the sake of safety, in case of an accident. The paper is fully illustrated by numerous large diagrams, showing the switchboard arrangement on several ships. Detailed information is also given on the wiring and the cables used. The attempts made to use the hull of the ship as return circuit are said to have been unsuccessful.—*Elek. Zeit.*, Nov. 22, 29.

Direct-Current and Three-Phase System.—EARLE.—A paper read before the Manchester section of the British Inst. of Elec. Eng. on the relative advantages of direct-current and three-phase distribution for small installations. He compares the weights of copper, and the suitability of the motors of both systems. He is strongly in favor of direct current. Where lighting alone is required, the first cost of polyphase or direct current would appear to be very similar; he prefers the latter on account of its simplicity as regards the wiring and the regulation of voltage. Wherever a number of motors are on the circuit, he considers that direct current shows a very decided advantage except in a few very special cases; moreover, the use of batteries is only possible with direct current, and is of considerable importance. Polyphase motors appear specially suitable for long lines of railway where considerable distances are traveled without a stop at a uniform rate of speed.—Lond.*Elec. Rev., Elec. Eng.*, Nov. 30; the latter journal also gives the discussion which followed.

Kyoto.—C. ISHIZU.—A short description of the new public power plant of the electric light company of this city in Japan. There is one improved horizontal Leffel turbine of the Niagara type, fitted with a Replogle relay governor; it develops 265 horse-power at 600 r. p. m.; one Stanley alternator of the inductor type, of 60 cycles, 3500 volts and 180 kilowatts. There are two transformers connected according to the Scott system, transforming 3000-volt three-phase current into 2000-volt two-phase. During the day three-phase 3000-volt current is supplied for power, while at night two-phase 2000-volt current is supplied for power and light.—*Elec. Friend*, Japan, October.

Dividends of Electrical Companies in Japan.—Statistics of the dividends of 16 electric light companies an one electric railway company in Japan. The maximum was 18 per cent of the Osaka Electric Light Company, and the minimum 7 per cent of the Tokyo-Yokohama Electric Railway Company. The average dividend between

January and June of this year was 13.87 per cent.—*Elec. Friend,* Japan, August-September, 1900.

REFERENCES.

Charging for Electricity.—PATTERSON.—An article recommending a system of charging, in which the consumer pays a fixed sum per year for the maximum demand which he purposes making upon the station, in addition to the meter charge, which is much lower than the usual meter charge.—*Am. Elec.,* December.

Single-Phase Alternating-Current Series System.—LEBLANC.—His Internat, Elec. Congress paper on such a system, with induction motors used as generators (ELEC. WORLD AND ENG., Sept. 15, p. 413).—*L'Eclairage Elec.,* Nov. 17.

WIRES, WIRING AND CONDUITS.

Distributing Network.—GILLIN.—The first part of an illustrated article on "The arrangement of the distributing network." He first discusses the want of balance in a three-wire system; he recommends observing great discretion in the connecting up of consumers by noticing particularly the probable time of demand and the nature of the load, and balancing consumers against one another in accordance with these observations; consumers on the same side of each street should be balanced against one another, and any difference in balance on one side of a street should be arranged to be compensated for by any opposing difference in balance on the other side of the same street or in one of the adjacent streets. He further discusses the maximum variation of pressure, which according to the Board of Trade regulations must not exceed 3 per cent of the declared pressure, and 2½ per cent in high-tension systems.—Lond. *Elec. Eng.,* Nov. 30.

REFERENCES.

Use of Condensers.—LEBLANC.—A paper, read before the Internat. Elec. Congress, in which he discusses the use of condensers for preventing accidents due to resonance phenomena in transmission and distributing lines. He has also tried condensers in connection with single-phase motors, but could not overcome the inherent practical difficulties.—*L'Eclairage Elec.,* Nov. 17.

Subways for Underground Mains.—An illustrated description of the 2½ miles of subways existing in London for the reception of gas, meter, hydraulic power and electric mains. They are, for the most part, built with their crown only a short distance below the surface of the roadway or footway, and with their floor above the sewer.—Lond. *Elec.,* Nov. 30.

Interior Wiring.—KNOX.—An illustrated article on the wiring of the 32-story Park Row Building in New York.—*Am. Elec.,* December.

ELECTRO-PHYSICS AND MAGNETISM.

Passive State of Metals.—HITTORF.—A German Electro-chemical Soc'y paper. He had already pointed out that the great differences in the electromotive behavior of chromium cannot be explained by the supposition that the surface of chromium in the active state is metallic, while in the passive state it is coated with a thin invisible film of oxide. This supposition has been made by Faraday to explain the passive state of iron. Hittorf gives in this paper his reasons why he does not agree with this hypothesis. He remarks that no positive proof has been given for the existence of an oxide film during the passive state. He compares the behavior of chromium and iron; the active state is the normal one for both metals. When under special circumstances—for instance, by making them anodes in an electrolyte—they become passive and those special circumstances are removed, then they return to the active state more or less quickly. This fact appears to him in disagreement with the supposition of an oxide film, for the oxides are insoluble and not volatile; they would remain and the passive state would also remain. Without being an anode, chromium takes the passive state by simple contact with many substances, as strong nitric acid, chromic acid, etc.; after the chromium has been removed from these substances, the passive state remains for some time. Iron takes the passive state in strong nitric acid, but loses it as soon as it has been removed. The only fact upon which the supposition of an oxide film, as the cause of the passive state of iron, might be based, was found by Schoenbein in the coloring of the metal by heat. The real oxide film which is produced in this case is not dissolved in nitric acid the specific gravity of which is about 1.3, and acts like a peroxide; it prevents an action of the acid upon the metal. If, however, the acid is less concentrated, for instance, of the specific gravity 1.2, the oxide film and metal are easily dissolved. It has been tacitly supposed that iron, colored by heat, is in the passive state, but this is not the case; if such iron is used as anode in a certain combination and the e. m. f. is measured by an electrometer before the circuit is closed, the e. m. f. is only slightly smaller than if iron with a fresh and clean surface is used. It is, therefore, impossible that the small e. m. f. obtained with really passive iron is due to a much thinner, invisible film of oxide. Nickel and cobalt can also take the passive state. In the discussion which followed Liebenow fully agreed with Hittorf and remarked that the passive state of metals is much more general than is usually supposed, and that silver and copper can also take it; also lead in the storage battery.—*Zeit. fuer Elektrochemie,* Oct. 11.

Electric Oscillations.—FLEMING.—An abstract of the first of a series of four Cantor lectures on "electric oscillations and electric waves," the frequencies being from 100,000 up to millions per second. He discussed the oscillations obtained by the discharge of a condenser. When one speaks of a frequency of 1,000,000 per second, this does not mean that there are really 1,000,000 oscillations each second, but that there are a few, say, 10 to 15 oscillations of that period corresponding to that frequency, then a pause, then another discharge, etc.; "just as would be the state of affairs if a clock were to tick for 10 seconds or 12 seconds and then to cease to tick for 24 hours, so is the proportionate duration of the alternate conditions of oscillation and quiescence." He distinguished between three kinds of resistance; the ordinary ohmic resistance, the resistance to ordinary alternating currents and the "oscillating resistance," which is greater than either of the others, especially when the oscillations are damped. The existence of damped oscillations implies a loss of energy by radiation as well as a dissipation by the true resistance.—Lond. *Elec., Elec. Eng.,* Nov. 30; *Lightning,* Nov. 29.

Silent Electric Discharge.—BERTHELOT.—A paper in which he coordinates the following three phenomena and shows that they involve essentially the same processes; the electric effluvium, the "silent atmospheric electricity," and the chemical action exhibited in a tube with walls at different temperatures and potentials. The reactions common to all three cases are the formation of ozone and the fixation of nitrogen. Whenever a gas is contained in an enclosure whose walls are at different temperatures an electric field is produced, which in its turn brings about a slight electric discharge resembling that in an ozone tube or in the atmosphere.—*Comptes Rendus,* Nov. 12; abstracted in Lond. *Elec.,* Nov. 30.

Magnetic Lines of Induction.—HELE-SHAW and HAY.—A paper describing a method of illustrating lines of induction in a magnetic field by a dynamical model, by means of the flow of a viscous liquid, the course of the stream lines being made evident by injecting into the clear liquid thin bands of a colored liquid. The magnetic intensity corresponds to the pressure gradient, the magnetic induction to the rate of flow per unit width, the permeability to the ratio of the latter to the former.—*Proc. Roy. Soc.,* Nov. 14; abstracted in Lond. *Elec.,* Nov. 30.

REFERENCES.

Coherer.—POPOFF.—The conclusion of his illustrated paper noticed in the Digest Dec. 15. He arranges the instruments so that when the resistance of the coherer has been diminished by a wave, a relay closes a circuit containing a bell; the tapping of the coherer immediately reduces its conductivity again. He gives an account of some experiments, and especially of measurements of electromagnetic disturbances in the atmosphere.—Lond. *Elec. Rev.,* Nov. 30.

Propagation of Electric Waves Along Parallel Wires.—MORTON.—His Brit. Ass'n paper in full, an abstract of which was noticed in the Digest Oct. 13.—*Phil. Mag.,* December.

Dark Space in Vacuum Tubes.—SKINNER.—A paper giving the results of a series of experiments made for the purpose of studying the relation existing between the potential gradient in the so-called Faraday dark space of vacuum tubes, and the conditions prevalent at the cathode. The results show the lower gradient (compared with that in the luminous column) to cathode radiation.—*Phil. Mag.,* December.

Thermoelectricity.—A reply of Liebenow to Voigt's criticism of his theory of thermoelectricity; and a second criticism of Voigt.—*Ann. der Phy.,* July and September; abstracted in *L'Eclairage Elec.,* Nov. 3.

Lifting Electromagnets.—CLARK.—An illustrated article, on the use of electromagnets for lifting bulky magnetic materials in mills and shops, and the most suitable construction of the magnets.—*Am. Elec.,* December.

Magnetic Field Due to a Moving Electric Charge.—Cremieu.—An account of experiments which seem to show that there is no magnetic field generated by a moving electric charge.—*Comptes Rendus,* Nov. 12; abstracted in Lond. *Elec.,* Nov. 30.

Electro-Chemistry and Batteries.

Potentials of Electrodes.—Nernst.—A German Electrochemical Society paper. The e. m. f. of galvanic cells is always the sum of the two e. m. fs. between the two electrodes and the electrolyte, and also of the e. m. f. between the two electrolytes, if the cell has two electrolytes in series; the latter e. m. f. is always small. It is nearly always of importance to determine the e m. fs. at both electrodes individually. For instance, when a storage battery is discharged, it is important to know whether the voltage drop has occurred at the anode or the cathode; a good storage battery should be so constructed that the voltage drop occurs nearly at the same time at both electrodes; for such measurements a third auxiliary electrode has long been used to advantage; with such a third electrode, of course, only the sum of two e. m. fs. is measured as before. He makes some brief interesting remarks about the drop electrode which has been said to have the e. m. f. zero and is based upon the theory of Helmholtz that between a mercury electrode polarized to the maximum of surface tension, there is no e. m. f.; he says that the correctness of this hypothesis has not been proved sufficiently by its application in practical experiments, and that also the hypothesis of Helmholtz does not seem to be in agreement with our present theoretical views. This question, however, seems of no practical importance at present, as the absolute potentials have no direct influence in any electrochemical investigation. He assumes arbitrarily the e. m. f. between a hydrogen electrode and a solution which is normal as regards hydrogen ions, as zero; then the e. m. fs. between any electrode and electrolyte can be determined in those terms. He gives a table of such e. m. fs. and an account of experiments of Wilmsmore to prove that the arbitrary choice of the hydrogen electrode for fixing the zero point in a table of potentials of electrodes, is thoroughly practical.—*Zeit. fuer Elektrochemie,* Nov. 8.

The Sulphuric Acid in the Storage Battery.—A German Electrochemical Society paper on "The Electrolysis of Dilute Sulphuric Acid Containing Iron." He made experiments with two gas-voltameters connected in series, one filled with pure sulphuric acid and the other with sulphuric acid containing iron, and compared the quantities of gas generated in both. The sulphuric acid had a specific gravity of 1.175. The addition of iron causes a loss of gas; when 0.01 per cent of iron is added, the loss of gas is 1.7 or 6.3 per cent for a current density of 2.217 or 0.360 amp. per square decimetre; for an iron concentration of 0.1 per cent, the loss of gas is 3.0 or 25 per cent for a current density of 6.4 and 0.355 respectively; for an iron concentration of 1 per cent, the loss of gas is 48.3 or 97.4 per cent for a current density of 2.230 and 0.228 respectively. It is therefore important that the sulphuric acid, used in the storage battery, is free from iron. He has found that it should be required that the iron concentration is less than 0.01 per cent. He gives the following quick method of testing: 10 to 15 cc. of acid are oversaturated with ammonia; if after some minutes no turbidity is produced by adding hydrated peroxide of iron, the sulphuric acid contains only 0.008 per cent of iron. Acid with 0.005 per cent of iron at once gets a blue color with ferrocyanide of potassium. Therefore, if an acid gives an iron reaction with ferrocyanide of potassium, but not with ammonia, it may be used for the accumulator. In the discussion which followed, Liebenow stated that in the battery manufacturing concern, with which he is connected, that it has been a rule for years that the sulphuric acid must not contain more than 0.008 per cent of iron. He also remarked that it has been doubted whether Faraday's law is always correct for all liquid conductors; it is easy to obtain apparent exceptions; when iron is added to the electrolyte of an accumulator it travels continually to and fro between the electrodes and carries oxygen from one to the other. In the discussion it was also suggested that the accumulator manufacturer should buy anhydrite of sulphuric acid and make the acid himself by the addition of water. It was replied that the anhydrite always contains dust, and when dissolved in water it is found to contain iron; the anhydrite is generally made and shipped in iron cases.—*Zeit. fuer Elektrochemie,* Nov. 8.

Commercial Electrolysis of Water.—Schmidt.—A German Electrochemical Society paper. He describes briefly the construction of a commercial water electrolyzer and discussed the practical application of hydrogen and oxygen for soldering purposes. He gave some figures to show that hydrogen may be used for lighting, and that in this respect it can compete favorably with acetylene. He claimed that specially constructed Welsbach burners, supplied with hydrogen, are very economical, so economical indeed that notwithstanding the indirect way of producing hydrogen by electrolysis of water, the same electrical energy yields as much light as in the best Nernst lamps. Nernst replied that it should not be forgotten that the electric lamp can be inverted, but that is not possible with the gas lamp; he did not doubt the high economy of light with hydrogen Welsbach burners, for some hours, but he believed that the Welsbach mantle would not stand it long, and that after a few hours the illumination would decrease very much. Schmidt replied that as these Welsbach mantles operate at high gas pressure, they can be inverted; regarding the life of the mantle he could not give definite information. Heraeus referred to a water electrolyzer, in operation for four years in his manufactory; to prevent the danger of explosion it is necessary to get the oxygen as free from hydrogen as possible; in his plant there is no danger, as he gets 98½ per cent of oxygen; the electrodes must be exchanged every year. Schmidt said he has had electrolyzers in operation two years and a half, and the electrodes did not have to be exchanged; their thickness has only decreased by 0.04 in.; he fills these apparatus with very pure carbonate of potassium.—*Zeit. fuer Elektrochemie,* Nov. 15.

Regeneration of Chromic Acid; An Acid Diaphragm.—LeBlanc.—A description of a practical method of electrically reoxidizing the reduced chromic acid resulting from its use as an oxidizing agent in many industries. The chemical methods of doing this are not satisfactory; the electrolytic method described is applicable to acid solutions; the cell is divided into two parts by a diaphragm, the anode being a lead plate in the reduced chromic acid; the cathode liquid also contains the same solution; on passing the current the anode liquid is oxidized into chromic acid while at the cathode hydrogen is evolved; the difficulty arises, however, that in this process some of the sulphuric acid will pass or migrate from the cathode into the anode chamber through the diaphragm, thus making the former poorer and the latter richer in acid; to overcome the latter difficulty, that which was the cathode liquid in one regeneration is made the anode liquid in the next, the reduced solution being, therefore, first used in the cathode chamber (an objection to this, though not serious, is that any oxidized chromium remaining in the original solution will first be reduced and will then have to be oxidized again in the second operation; if the reduction in the original solution is complete, then this loss will not exist). By this process the solution will always remain the same notwithstanding the traveling of the acid through the diaphragm. He thinks, in general, an efficiency of 70 to 90 per cent may be obtained, although this depends greatly on the temperature and impurities in the solution. The voltage also will vary, but will generally lie between 2.7 and 4. The second part of the paper deals with diaphragms for acid solutions, as it was found impractical to attempt to regenerate without a diaphragm; after describing some unsuccessful attempts of making diaphragms, he found the following method to be very satisfactory. The composition is 25 per cent of aluminum oxide and 75 per cent of silicum oxide after being baked; it is a plastic mass while it is being shaped; it is possible to manufacture even large plates and cups of this kind and they are thoroughly acid-proof, having been in use for over a year; the thickness may be from 4 to 7 mm. An idea of the resistance can be obtained from the fact that a plate 5 mm thick in a sulphuric acid solution of 20 degs., with a current of 0.02 amperes per sq. cm causes a fall of potential of 0.15 volt, which is very little. It has not yet been found that such plates will clog and increase their resistance; they are not suited for alkaline solutions. The discussion brought out the fact that such diaphragms are not new.—*Zeit. fuer Elektrochemie,* Nov. 15.

Electrolysis of Fused Salts.—Lorenz.—A long, illustrated German Electro-chemical Society paper, in which he described several apparatus used in the electrolysis of fused salts and gave an account of a long series of experiments. It is now possible to develop a theory of the electrolysis of fused salts up to a temperature of 1000 degs. C. Faraday's law is also fully correct for fused salts, although the results obtained in a simple apparatus are not always according to that law. He also proved the correctness of the Gibbs-Helmholtz formula for the relation between the e. m. f. of a cell, the heat-toning, and the temperature coefficient of the e. m. f.; this was proved for fused chloride of lead between 900 and 500 degs. C. He mentioned a "fused Daniell cell," consisting of fused chloride of zinc and fused chloride of lead, with zinc and lead electrodes, which has a very small temperature coefficient of e. m. f.; also "fused concentration cells,"

for which he found the formula of Nernst to be correct.—*Zeit. fuer Elektrochemie,* Nov. 15.

Deposition of Iron and Nickel.—KUESTER.—A German Electrochemical Society paper on the electrolytic deposition of iron and nickel from a mixture of solutions of their sulphates. The peculiar result has formerly been found by Toepffer that the deposits become richer in iron the smaller the current density. He gives an account of measurements of Steinwehr, showing that the voltage of decomposition is smaller for nickel than for iron, on the average about 0.1 volt. —*Zeit. fuer Elektrochemie,* Nov. 8.

Tin.—An abstract of a German Electro-chemical Society paper. There are two modifications of tin; above 20 degs. C. the white tin is the stable state, below that temperature it is the gray tin. The changing over from one process to the other is a reversible process. The discussion which followed is also abstracted.—*Zeit. fuer Elektrochemie,* Oct. 25.

REFERENCES.

German Electro-Chemical Society.—A full account of the proceedings and the papers read at the annual meeting of this society, recently held in Zurich, Prof. Van't Hoff being the president. There was an exhibition of each of the Swiss electro-chemical companies, showing all the products made by electro-chemical processes in Switzerland. A paper on the education of the electro-chemist was read by Lorenz. A report on the fourth international congress for applied chemistry in Paris was given by LeBlanc. Also a report on the electro-chemical processes, apparatus, and products at the Paris Exposition by Quincke. The other papers are abstracted elsewhere in the Digest.—*Zeit. fuer Elektrochemie,* Oct. 11, 25; Nov. 8, 15, 22.

Mangano Salts.—ELBS.—A brief note of a purely chemical nature, presented to the German Electro-Chemical Society, on the behavior of mangano salts at the anode.—*Zeit. fuer Elektrochemie,* Nov. 8.

Electrolytic Reduction.—LOEB.—A German Electro-Chemical Society paper on electrolytic reduction processes in organic chemistry.—*Zeit. fuer Elektrochemie,* Nov. 15.

Speed of Reaction of Electrolytic Reductions.—GOLDSCHMIDT.—A German Electro-Chemical Society paper in which he gives an account of experiments made to study the relation between the speed of reaction and concentration of the substance to be reduced in an electrolytic reduction.—*Zeit. fuer Elektrochemie,* Nov. 8.

Ferrates.—HABER.—A German Electro-Chemical Society paper of a mere chemical nature, on the soluble alkaline salts of iron oxide and ferric acid.—*Zeit. fuer Elektrochemie,* Oct. 25.

Solution Pressure.—PALMAER.—An illustrated German Electrochemical Society paper in which he describes an experiment for demonstrating Nernst's solution pressure and for verifying Nernst's views of the capillary-electric phenomena.—*Zeit. fuer Elektrochemie,* Nov. 15.

Distribution of the Current on the Surface of an Electrode.—NORDEN.—A German Electrochemical Society paper, in which he describes a method for measuring the current density at each point of an electrode. The method is based on the same principle as his method for determining the real surface of an electrode (Digest, Mar. 3).—*Zeit. fuer Elektrochemie,* Nov. 22.

UNITS. MEASUREMENTS AND INSTRUMENTS.

Wheatstone Bridge.—GRIFFITHS and WHETHAM.—An abstract of a Brit. Phys. Soc'y paper on a cheap and easy method of getting a self-adjusting Wheatstone bridge to show on a scale the actual resistance of any wire. Contact with the bridge wire is made by means of a light horizontal bar, which is suspended by a phosphor-bronze strip from the coil of the d'Arsonval galvanometer used with the instrument. A second bar, parallel to and above the first, is rigidly connected with the coil. A wooden beam, worked by clockwork, moves up and down between the bars and clamps them alternately. When the beam is down, contact is made with the bridge wire. If this contact is not at the zero point, a current will flow through the coil, and if the cell is connected up the proper way, it will turn the coil so as to bring the upper bar nearer to the zero point. This puts a twist into the phosphor-bronze strip, and when the beam rises and clamps the upper bar, the torsion comes into play and brings the lower bar under the upper one. The beam then descends and makes contact at this point, and if any current flows through the galvanometer there is a further movement until the zero point is reached. Any alteration in the resistance of the wire under experiment causes a movement of the zero point on the bridge wire, and this is followed by the lower arm. The position of the lower arm can be directly indicated by means of a scale.—Lond. *Elec. Eng.,* Nov. 30.

REFERENCES.

Meters.—ARMAGNAT.—Brief illustrated descriptions, taken from patent specifications, of several new types of meters.—*L'Eclairage Elec.,* Nov. 3.

Induction Coil.—An illustrated description of an induction coil giving a 40-in. spark, made by Queen & Co. for the Japanese Government.—*Am. Elec.,* December.

Error in Ballistic Galvanometer.—BEATTIE.—An illustrated paper on a possible source of error in the use of a ballistic galvanometer, when the magnetic axis of the needle does not lie exactly in the plane of the coil. He calculates the magnitude of error, when a condenser is discharged or charged through the galvanometer.—*Phil. Mag.,* December.

Platinum Silicium Resistances.—HABER.—A brief German Electrochemical Society paper on new resistances of Heraeus, and on experiments made by Rodt with them, as noticed in the Digest Nov. 10. —*Zeit. fuer Elektrochemie,* Nov. 8.

Electric Traction and Magnetic Records.—RUCKER.—A reply to Evershed's communication. He does not agree that magnetic records have been made long enough, and shows what would be lost if the old magnetic observatories would be closed on account of the tramways. —Lond. *Elec.,* Nov. 30.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraphy and Telephony.—A long editorial referring to Gavey's paper on telegraphic and telephonic exhibits (Digest, Sept. 15). A cheap and high speed printing instrument is wanted. The Rowland instrument is said to be a thing of awe-inspiring complexity. Each Mercadier set is equipped with 50 or 60 relays. "The new Pollak-Virag writing telegraph is perhaps more promising, combining as it does the principle of the Wheatstone automatic system with that of the writing telegraph, but it labors under the disadvantage at present of a photographic recording process, and so far is also fairly complicated and requires delicate adjustment." A brief review is given of the progress in telephony. Regarding Poulsen's telegraphone, it is said that as a scientific experiment it is as conclusive as it is brilliant, "but up to the present it is still an undeveloped scientific experiment, and great modifications will have to be made in it before it can become a practical instrument to replace the office boy in connection with subscribers' telephone instruments."—Lond. *Elec.,* Nov. 30. A full account of the discussion which followed Gavey's paper, is given in Lond. *Elec.,* Nov. 30; more briefly in *Lightning,* Nov. 29; Lond. *Elec. Rev.,* Nov. 30.

REFERENCES.

Telegraphone.—POULSEN.—An illustrated article, in which the inventor himself describes his recording telephone, mentioned repeatedly in the Digest. He gives the general principle and discusses the processes of inscription, reproduction and obliteration. Besides common piano steel wires he uses steel ribbons and nickel wires as writing bases. Brief reference is made to the applications of the invention for "telephonic newspaper" and a telephonic relay.—Lond. *Elec.,* Nov. 30.

Interior Telephone Systems.—HENRY.—A continuation of his long illustrated serial. A method of automatically restoring the original connections by hanging the telephone receiver on its hook is described; also the intercommunicating telephone system of the Ericsson Tel. Co.—*Amer. Elec.,* December.

Motions of Telephone Diaphragm.—SHAW.—His Brit. Phys. Soc'y paper in full on "An electric micrometer," an abstract of which was noticed in the Digest Apr. 28.—*Phil. Mag.,* December.

Cable Laying in Arctic Waters.—PORTER.—An illustrated account of the laying of the St. Michael-Cape Nome cable and the wreck of the cable ship Orizaba.—*Elec. Rev.,* Dec. 5.

MISCELLANEOUS.

Electric Oven.—NERNST.—A brief illustrated German Electrochemical Society paper, in which he describes a small electric oven for experimental purposes, which enables one to easily generate and maintain constant temperatures up to 1400 degs. C. A platinum

iridium wire is used, wound on a tube of refractory material. For measuring the temperature a thermocell is placed in the bottom of the oven. The current consumption is 2.4 amp. at 110 volts.—*Zeit. fuer Elektrochemie,* Nov. 8.

REFERENCES.

Paris Exposition.—The thirteenth part of the long illustrated serial, dealing with switchboards and special switches.—Lond. *Elec.,* Nov. 30.

Aliamet.—The first part of a very long illustrated serial on electric measuring instruments at the Exposition. This part deals with galvanometers, electrometers and voltmeters.—*Bull. de la Soc. Internat. des Elec.,* July-August.

Brochet.—An illustrated description of an apparatus of Poulenc and Meslans for the industrial manufacture of fluorine.—*L'Elec.,* Nov. 3.

Bainville.—An illustrated description of the Thury arc lamp, made by Cuenod, of Geneva.—*L'Elec.,* Nov. 3.

Montpellier.—An article on the retrospective exhibition in the Russian department.—*L'Elec.,* Nov. 3.

Electrical Engineering a Profession or Trade.—Perry.—The first part of a reprint in full of his presidential address, abstracted in the Digest Dec. 8.—*Sc. Amer. Sup.,* Dec. 8.

Tool Manufacturing Plant.—Continuations and conclusions of the illustrated description of the works of Ludwig Loewe & Company, of Berlin, noticed in the Digest Nov. 17.—Lond. *Elec. Rev.,* Nov. 2, 16, 30.

New Book.

Theorie und Berechnung der Wechselstromerscheinungen. Von Charles Proteus Steinmetz. Berlin: Reuther & Reichard. 512 pages, 189 illustrations.

This is a translation into the German language of Mr. Steinmetz's well-known work on "Alternating-Current Phenomena." It is intermediate between the first and second editions of the American work, since it contains several addenda and pages of additional matter which the first edition did not contain, but does not contain all the material of the second edition. The translation seems to have been very faithfully rendered and the algebraic formulæ carefully printed. The work will be a valuable addition to German literature, where the plane-vector system of alternating-current notation has not yet taken deep root.

Directory of Electrical Societies, Etc.

Canadian Electrical Association. Next meeting, Ottawa, Ont., 1901.

American Street Railway Association. Next meeting, New York, October, 1901.

Northwestern Electrical Association. Next meeting, June, 1901.

National Electric Light Association. Next meeting, New York, 1901.

International Association of Municipal Electricians. Next meeting, Niagara Falls, N. Y., September, 1901.

Wood Preservation.

The subject of wood preservation is one that presents many difficult problems and has long been the field for extended investigation by both purely scientific and practical men. Almost every substance known to chemistry has been experimented with in this direction, the Germans having been particularly exhaustive in their endeavors, as is their wont. That some system of impregnation, as distinct from superficial application, is desirable, seems to be the general consensus of opinion of these investigators and the most effective method of preservation along this line is that perfected by Mr. Fritz Hasselmann, an engineer of Munich, and known as the "Hasselmann Process." It is growing in favor in this country for the treatment of railroad ties, telegraph, telephone and electric railway poles and cross arms, and all other similar subjects where the decay and depreciation forms a large drain on the capital invested. The company exploiting the system in the United States is the Barschall Impregnating Company, New York, with a plant at Perth Amboy, N. J., for applying the process to the timber.

There is no longer any doubt that timber rots from the action of fungus growths which attack it. These fungi not only destroy the cells which contain them, but form substances which decompose the wood fibre itself and reduce the entire structure to mould. This fact was not thoroughly understood by the early investigators, and consequently many faults are to be found in the processes which they attempted. One of the gravest omissions made in these former processes was the absence of permeation of the wood. Charring or superficial treatments with tar, asphalt, fats, oils, resins or other gums, etc., recommend themselves by their cheapness in first cost, but to truly calculate the matter of expense, the prolongation of life which they give the material must be considered. In the ideal wood preservative, furthermore, it does not suffice that the penetration reaches only the soft and easily decayed portions, but the impregnation must enter the walls of the cells themselves, and the fungicide or antiseptic material must not only thoroughly permeate the timber, but must chemically combine with the wood. Certain characters of solutions allow of this permeation, but others, like glue, fats, oils, etc., cannot be made to penetrate the woody fibre at all. If, therefore, a solution can be found which will not only permeate the wood, but enter into the desired chemical combination therewith, the problem is theoretically solved, and its practicability depends only upon the cost of the reagents and of the mechanical process of application.

The salts of mercury, silver, copper and iron have proved themselves to be among the best for this class of work, but the cost of the first two prohibits their use commercially. Mr. Hasselmann succeeded in discovering a proportionate mixture of the copper and iron salts which possesses marked excellence as an antiseptic when in solution with water, which readily gives the desired penetration and which chemically forms an insoluble combination with the woody fibre. From a commercial standpoint the process shows a much lower first cost than previous methods and promises a much greater length of life—in other words, it is a more efficient preservative from every standpoint.

The plant of the Barschall Impregnating Company at Perth Amboy, which is now in active operation, has a capacity of 15,000 cubic feet daily. It consists of three long iron cylinders 6 ft. in diameter, one of 61 ft., one of 81 ft. and one of 125 ft. in length and the necessary boilers, vacuum pumps, vats for mixing the solution, etc. A rack runs the entire length of these cylinders, on which cars carrying the timber rest, and the end of the cylinder is closed by a heavy door, firmly bolted into place after the charge has been introduced. The wood is first subjected, for about two hours, to a vacuum of 23 ins. to 25 ins., which removes the air from the cells and leaves it in a condition peculiarly adapted to receiving the impregnating solution. By connecting the vats containing this solution with the treating drum, the latter is filled by suction. Steam is then admitted at a temperature of from 212 degs. to 275 degs. F., which corresponds to a pressure of from about one to three atmospheres, and the entire mass is kept in a state of ebullition for three to six hours longer. This long boiling under pressure impregnates the wood in a most thorough and satisfactory manner, so that tests made on pieces thus treated show that the chemicals have penetrated to the innermost sections. The cylinders are covered with a mixture of asbestos and hair surrounded by canvass, which easily maintains the temperature without serious condensation.

The solution used in the Barschall process consists of a combination of iron, copper and aluminum sulphates and a substance called "kainit" dissolved in water. The kainit is a natural salt which consists principally of sulphates of potassium and magnesium and chloride of magnesium. The total amount of chemicals in the solution is about 6 per cent, and one solution can be used repeatedly for eight or ten times if 1 to 2½ per cent more chemicals be added between each boiling.

When the wood is removed and dried after treatment it retains its original color, is odorless and is perceptibly hardened. It is stated that pine or other soft wood subjected to the process is made suitable for taking the place of oak as a structural material and that it becomes susceptible of being highly polished. A further advantage, especially over the creosote treatment, is the reduced inflammability of the impregnated wood.

This process has met with marked success in Germany, Russia and England, and has been officially endorsed and adopted by many German railroads and private corporations. Its introduction into this country is progressing in a satisfactory manner, as numerous railroads, telephone and electric companies have become interested and are investigating its merits.

International Storage Battery.

A new type of storage battery being placed upon the market by the International Storage Battery Company, 45 Milk Street, Boston, Mass., is illustrated in the accompanying engravings. The company lays stress upon the statement that no new chemical or electrical principles are involved, the invention being of a purely mechanical nature and relating to the construction of the element.

The structural part of an element consists of two halves or sections made of porous non-conducting earthenware, which form a chamber in which the active material is contained. As will be seen from the illustrations, the inner surfaces of the halves or sections of the vessel are cellular in construction, the exterior surface being ribbed. The

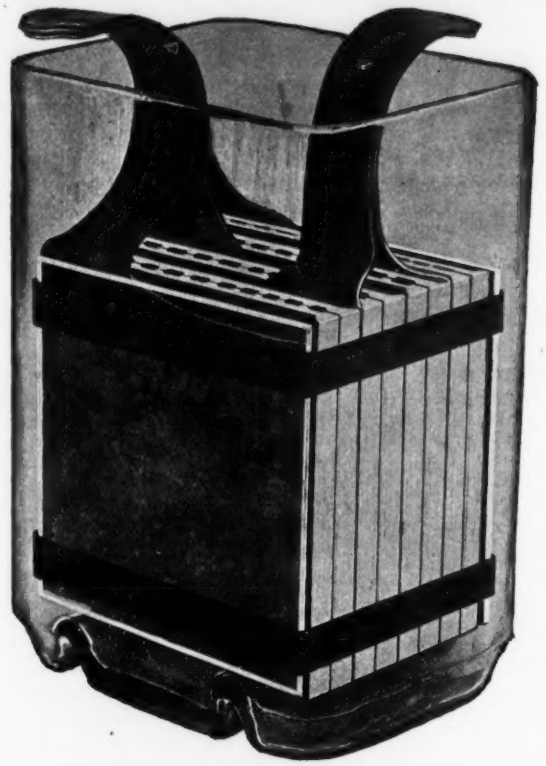


FIG. 1.—INTERNATIONAL STORAGE BATTERY.

halves or sections which form the sides and bottom of the chamber are united by means of suitable cement so that the chamber is practically fluid tight. The walls forming the extensions are made relatively wide so as to form substantial cementing and abutting surfaces, and also to serve to strengthen the structure and halves or sections. In the chamber of the closed vessel thus formed of two halves or sections is first placed the lead oxide or material to become active, and into this material is then inserted a lead conducting sheet, which latter performs the office of a conducting electrode.

The makers state that the enclosed oxides are freely accessible throughout to the electrolyte of the cell, being exposed thereto

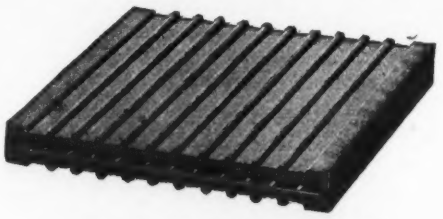


FIG. 2.—EXTERIOR OF ELEMENT.

on all sides; and since this end is attained without undue compression, a maximum porosity always exists throughout the active mass. The elasticity of the element also provides for the maintenance of this porosity during the charging and discharging processes, which is so essential during any heavy régime of work.

The claims made for this type of battery are that it is lighter than any other and highly efficient, has a lower first cost, costs less to maintain, and is more durable—variable and abnormal draughts of current not affecting its life. It is excellently adapted to central station work, as the confinement of the active material avoids deterioration of the element. The elements being practically solid, they can be used for traction or carriage service—automobile and train—without danger of disintegration by jolting or concussion. The company

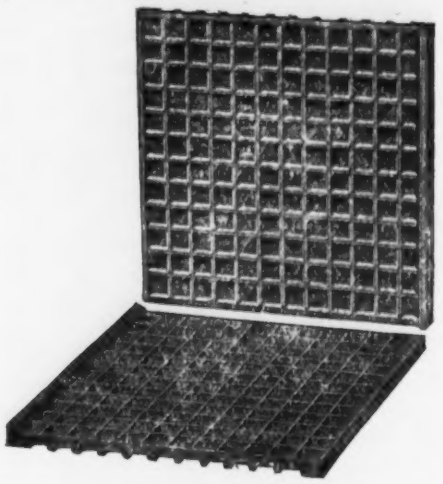


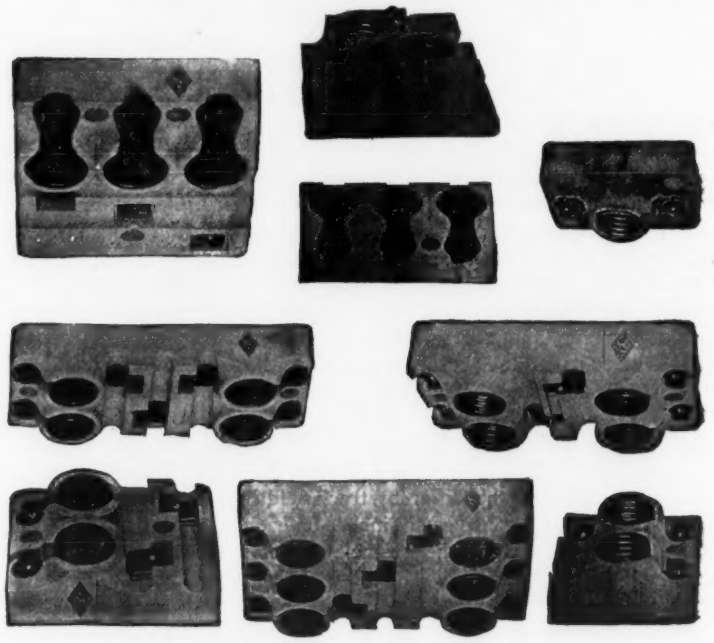
FIG. 3.—INTERIOR SURFACE OF ELEMENT.

guarantees the maintenance of its batteries for 10 per cent per annum of the original cost where used for installations of large capacities, as in central station work or railway carriage service.

Low Potential Cut-Outs.

The present day requirements of cut-outs, even those for low potential circuits, are in great contrast with what was thought good enough for this service even a few years ago. The 1900 National Electrical Code, for example, requires that fusible cut-outs shall be held free of contact with any portion of the base, and in this connection it is interesting to note that the first type of fusible cut-out—the Edison plug—is among the few that are not barred by this latest insurance requirement. In the accompanying illustrations a number of the most modern forms of this type of cut-outs are illustrated.

As will be seen, the illustrations include single and double-pole



LOW POTENTIAL CUT-OUTS.

main-line cut-outs; double-pole, single and double and crossover branch cut-outs; three-wire single and double branch cut-outs; three-wire main-line cut-outs, and three to two-wire double branch cut-outs.

It may be added that the plug type of cut-out is now almost invariably used in armored conduit work, as it requires much smaller distributing boards. The cut-outs illustrated herewith are made by the Anchor Electrical Company, of Boston, Mass. The porcelain is selected to have maximum strength and to be thoroughly vitrified. All shells are made of copper.

National Automobile Exhibition at Convention Hall, Washington, D. C.

THIS splendid exhibition of the progress made in the development of automobiles was begun on Monday evening, Dec. 10, and from the time the doors were thrown open was thronged with interested spectators. On the evening of Dec. 12 the attendance was greatly swelled from the thousands of out-of-town visitors attending the Centennial of the establishment of the National Capitol at Washington. The exhibition was a success in every particular, as the number of exhibitors and the attendance exceeded the most sanguine expectations.

The scene presented in the immense hall was a novel one. The great roof was decorated with streamers, flags, incandescent lights, etc. The centre of the hall was railed in and divided into sections for the exhibitors. Around them was a one-eighth-mile wooden track 20 feet wide, on which was a continual procession of electric, steam and other power-propelled vehicles. Along the sides of the hall were the reserved seats and private boxes, which overlooked the track.

Access to the exhibits was obtained by a bridge crossing the track at the hall entrance, a double flight of steps leading to each end of the bridge. The show was largely patterned after the exhibitions in New York. For instance, in one corner of the hall was a large space with runway connecting with the track; in this space there were many vehicles kept for exercising on the track, to which access was had at all times by the removal of the stout bar across the entrance. Precautions were taken to prevent accidents, and the track patrols saw that all the rigid rules were obeyed.

In the arena were automobiles of all classes, and grouped about them were exhibits of automobile accessories. The exhibitors, of course, had their sections enclosed, and the number and variety afforded opportunities for considerable display.

The work of securing the exhibitors and preparing the hall for them and the spectators is due to Messrs. Edward Reynolds, manager; W. J. Foss, Washington manager of the American Bicycle Company, treasurer, and Randolph Jose, secretary. The following were the exhibitors: American Bicycle Company, Automobile & Manufacturing Company, Electric Vehicle Company, Woods Motor Vehicle Company, Riker Motor Vehicle Company, De Dion-Bouton Motorette Company, Overman Automobile Company, Knox Automobile Company, Pennsylvania Horseless Carriage Company, Mobile Company of America, Locomobile Company of America, New York Belting & Packing Company, Rose Manufacturing Company, and a large number of local dealers in sporting and other goods.

The track was open daily from noon till nearly midnight, and was in use all of that time. Local automobile enthusiasts shared its use with the exhibitors, and very generously assisted in entertaining the crowds by treating them to a spin on the track. While the limit was eight miles an hour, there were times when friendly contests of speed were apparent between owners of rival vehicles. The Beck Brothers, of Oakland, California, were especially in evidence with their mobiles. In the braking and obstacle contests entries were made from all classes of vehicles, and these contests were the source of much amusement to the onlookers. There was no variance in the contests from the plans followed at the Madison Square Garden exhibition. On Tuesday night the slow and careful drivers lost on time and only one contestant failed to foul a barrel or the pen. Allowances were carefully made for the different track widths of the vehicles, each being allowed a clearance of six inches on each side between obstacles.

On Wednesday night the obstacle contests were more of a success, and two drivers who handled their vehicles most skilfully, covered the distance in 20 and 20⅗ seconds respectively, without fouling any of the obstacles.

Little can be said of the results of the braking contests as there was too wide a range in the speed of the vehicles when they crossed the line, when they were required to put on brakes—and it was known too that some of the brakes were rosined for the occasion.

The Electric Vehicle Company had the largest exhibit of electric vehicles at the show, and also had several more vehicles outside the hall. The majority of the vehicles of this very handsome exhibit were new to Washingtonians. The following list composes part of their exhibit: Mark XII. runabout, Mark XII. victoria, Mark XIX. delivery wagon. Mark XIX. cabriolet, Mark XIX. surrey, Mark III. stanhope, Mark XI. wagonette, Mark XI. six passenger bus, Mark VII. gasoline jaunting car, and Mark VIII. gasoline runabout. The Electric Vehicle Company, besides laying a new floor, finished with hard oil, enclosed the entire section with ornamental iron railing. On the posts of the corners and openings were mounted red incandescent lamps surrounded by white globes. At night, of course, the globes showed red and the effect was very pretty. Mr. J. M. Hill was in charge of this exhibit.

The Woods Motor Vehicle Company, of Chicago, exhibited nine vehicles, and had the second largest exhibit of electrical vehicles, and one of the finest ever shown by them. The special attraction of their exhibit was a "Queen" Victoria. This is a low carriage with an odd front, doing away entirely with the dashboard effect, substituting an artistic box containing a small tray of batteries; an extensive front brougham, also of new design, and ten other styles, which have already been shown elsewhere, but not in Washington. Mr. A. E. Chandler, formerly secretary of the company, was in charge. Mr. R. A. Green, sales manager, was in attendance during the week.

The Riker Motor Vehicle Company, recently consolidated with the Electric Vehicle Company, showed quite a variety of electric vehicles. On exhibition were a victoria, two runabouts, delivery wagon, four-seated brake, demi coach, and an ambulance. It was not thought necessary to exhibit their street-railway emergency wagon in the hall, as one of them has been in use for nearly a year by the Metropolitan Railroad Company and is quite well known to the Washington public. The victoria "de luxe" was greatly admired by those who fully appreciated its elegance and artistic beauty, as well as its comfort. The body is supported by the usual combinations of springs and leather strap slings seen in the horse drawn Victoria; the battery consists of two trays, carried on springs resting on the running gear. The luxurious cushions, well tempered springs and the rubber tires give the occupants a motion more like gentle floating through space, than of being propelled over roadways.

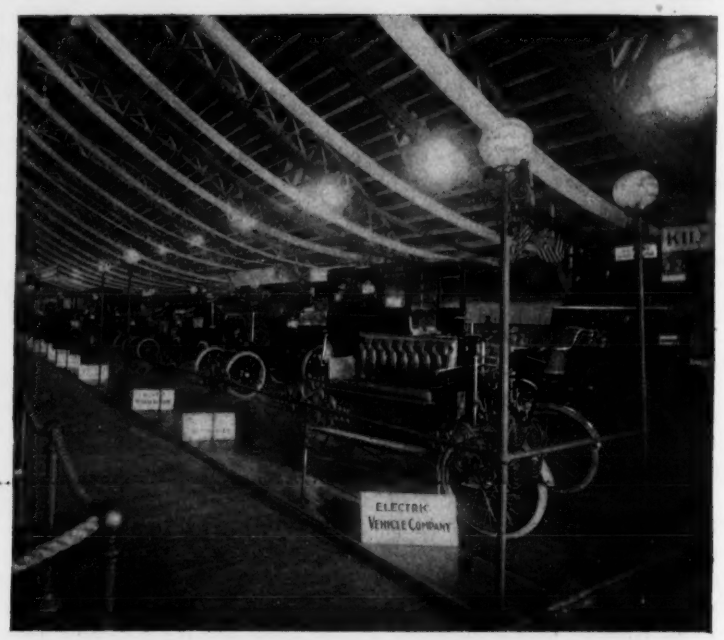
The American Bicycle Company, manufacturers of Waverly electric vehicles, occupied a section to the right of the main entrance and opposite to the reserved seats. It showed a four-passenger surrey, stanhope, combination delivery wagon and brake, road wagn, and a very attractive, light road wagon, weighing about 900 lbs. Two-seated Toledo steam road wagon, Rambler gasoline, stanhope, and a Cleveland gasoline tricycle.

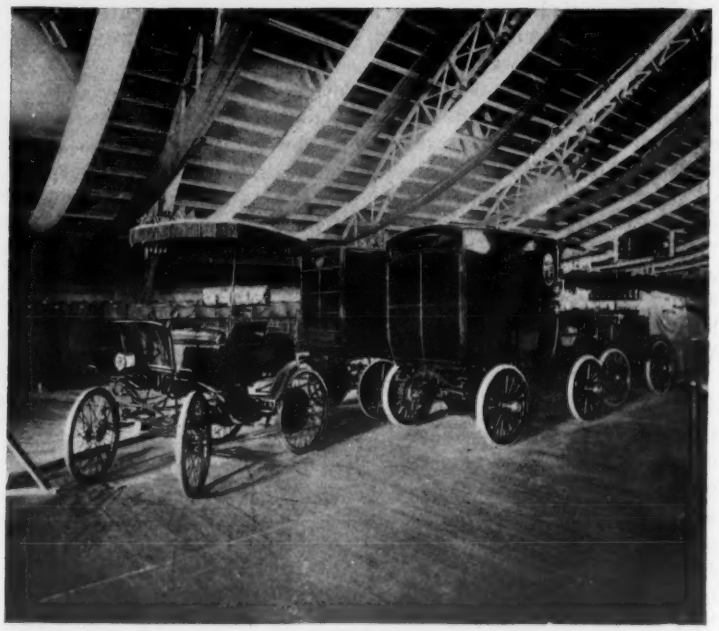
The electric road wagon is very popular in Washington and the Waverly is well represented on the streets. The many merits of this vehicle were fully covered in the description of this exhibit at the Madison Square Garden that appeared in our issue of Nov. 10.

The Automobile and Manufacturing Company, of Baltimore, Md., exhibited three dos-a-dos, two delivery wagons, and several gasoline vehicles. The ten auto carrettes, now operated over certain streets in Washington, were built by this company. Another installment of these vehicles is now under construction for the Washington Company. Many improvements have been made in the construction of this vehicle, and the result of these changes is an automobile with a large passenger capacity always readily controlled by the driver. (See Fig. 6.)

The De Dion-Bouton Motorette Company exhibited five vehicles consisting of a 3½-hp motorette, 5-hp doctor's brougham, 5-hp motorette, 2¾-hp quadricycle, and its 2¾-hp Brooklyn type. This exhibit drew large crowds, which showed particular attention to the motorette, which made the run from New York to Washington in 17 hours and 50 minutes, actual running time. The driver stated that from Newark to Philadelphia the run was over good roads, but that as he approached Baltimore they became worse and worse. The road from Baltimore to Washington, he said, was more like a newly ploughed field after a rain, than the highway between two large cities. Notwithstanding these difficulties the vehicle came through intact, and before being cleaned up was run for many miles for exhibition purposes over the smooth streets of the National Capital.

It would seem not unreasonable to ask manufacturers of electric automobiles to adopt a universal plug for charging batteries, and to devise a smaller and more convenient key for cutting off the power when vehicles are left for any purpose. The need of these changes has been brought out again by the shows. The citizens of Washington were greatly pleased with the exhibits, and on Dec. 12 when sixteen automobiles abreast brought up the rear of the Centennial parade they received an ovation greater than that given any of the regular paraders. One very amusing feature of the automobile parade was the ringing of the bells to the exact time of the drum in the band just ahead. It caught the crowd. The show closed on Saturday, Dec. 15, having enjoyed a week of prosperity for the managers and exhibitors.





WASHINGTON, D. C., AUTOMOBILE SHOW.

FIGS. 1 TO 6.—GENERAL VIEW, OBSTACLE COMPETITION AND SOME OF THE LEADING EXHIBITS.

Exhibits at the Röntgen Society Meeting.

On the occasion of the first regular meeting of the Röntgen Society of the United States, which was held last week at the Grand Central Palace in New York, there were several exhibits of Röntgen-ray apparatus.

Green & Bauer, Hartford, Conn., was represented by Mr. Green, who exhibited some "Monell" tubes, of which they are the sole manufacturers.

Van Houten & Ten Broeck, New York, exhibited a twelve 32-in. plate static machine operated by a ⅓-hp motor. Dr. H. L. Mason, who represented the company, pointed out that the machine gave a longer spark than any like machine on the floor. It gave a spark 20 ins. in length.

Oelling & Heinze, Boston, Mass., exhibited an outfit of its new Röntgen-ray apparatus in a dark room for the better demonstration of the effectiveness of the apparatus. The universal coil, it is stated, gives results more brilliant and is practically as steady as large static machines.

Truax, Greene & Company, Chicago, made a display of Crookes tubes and of photographs made by the use of its tubes. The claims made by this firm for its products are a steady supply of fluorescence and shortened exposures. The tubes are adapted for use with either static machines or coils.

The Universal Electric Stage Lighting Company, New York, showed electric lamps designed for the purpose of producing violet rays. These rays, it is stated, are of great value in the treatment of tuberculosis, skin diseases and other germ diseases, being destructive to all forms of germ life.

The Swett & Lewis Company, Boston, Mass., had a large supply of vacuum tubes. The features of the tubes were practically demonstrated in connection with a large Waite & Bartlett static machine, and a Kinraide induction coil. Mr. Frank H. Swett was in charge of the exhibit and did some effective work in behalf of his company.

The Kny-Scheerer Company, New York, was represented by Mr. James M. Fischer. The company showed one of its complete induction coil outfits in practical operation. The coils can be used on direct currents of 110, 120 and 250 volts. A feature of the exhibit was the adjustable vacuum tube. This tube is provided with an arrangement by which the anti-cathode is kept cool by flowing water. It is claimed that this prevents the deterioration of the vacuum and insures a practically constant degree of penetration and definition.

The Electro-Therapeutic Manufacturing Company, Indianapolis, Ind., had a large exhibit of its varied lines of electro-therapeutic apparatus. The exhibit included a large Patee static machine, a combined galvanic, faradic and static cabinet; cabinet battery, galvanic and faradic wall cabinet, faradic batteries, electrodes, etc. Mr. E. L. Richter, of Philadelphia, Pa., is agent for the company, the exhibit being under his charge. Mr. Richter also represented Queen & Company, of Philadelphia, and showed the Queen self-regulating tube in practical operation.

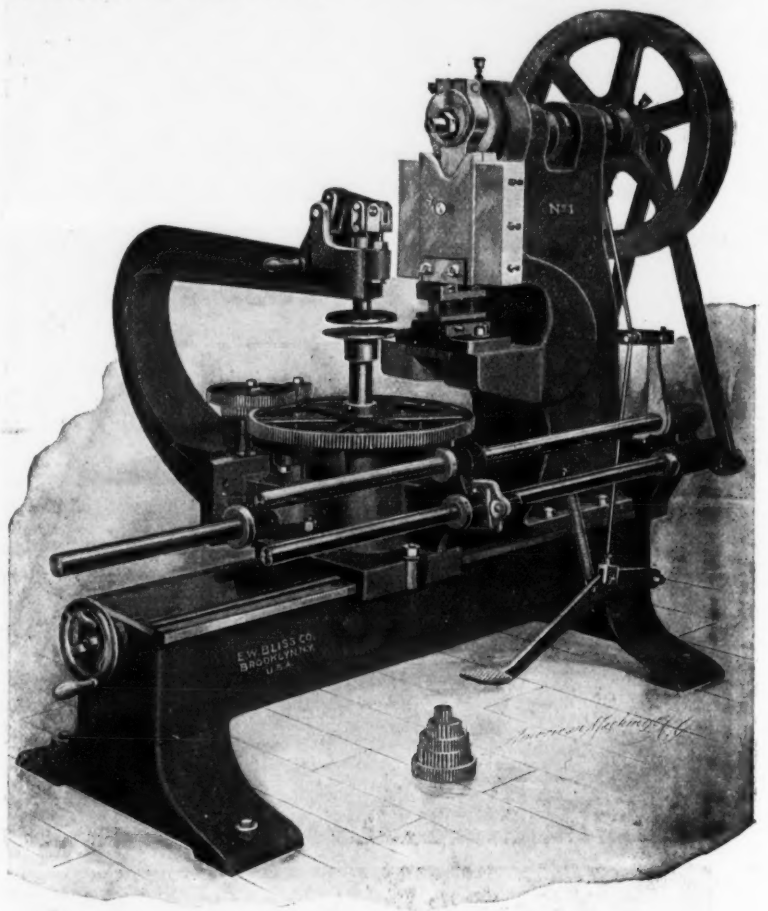
The General Electric Company made an exhibit of 8-in. and 12-in. Thomson induction sets; an alternating current set; fluoroscopes, and a full line of vacuum tubes for demonstrations. A new tube, shown for the first time, contains a conical reflector for the purpose of concentrating the rays on a limited area of the tube, thus avoiding loss of power by the scattering of the rays. An improvement in fluoroscopes was also shown. The plate is protected by a sheet of gelatine, which is entirely transparent to the rays. This preserves the fluoroscope plate from damage by external means. The exhibit was looked after by Mr. W. S. Andrews, from Schenectady, and Mr. H. Westbury, from the company's lamp works, at Harrison, N. J.

The Waite & Bartlett Manufacturing Company, New York, made an extensive exhibit of its apparatus. The principal feature of the exhibit, as far as size goes, was a large static machine. It has 24 plates, operated by a ¼-hp Victor motor. It is capable of producing a 17-in. spark. Other apparatus displayed were a current adapter for cautery purposes, taking 40 amperes at 6 volts; a rotary converter for the generation of sinusoidal current; a switchboard for obtaining galvanic and faradic currents from direct current, without the use of a lamp to reduce the pressure (the resistance being introduced by means of resistance coils), and a centrifuge, with urine and blood attachments. The centrifuge is operated by a small motor in the base of the instrument, the armature revolving horizontally. The company also showed several Röntgen-ray photographs. The exhibit was in charge of Dr. Harry Waite.

New "Bliss" Armature Disk-Notching Press.

In the illustration herewith is shown a new automatic armature disk-notching press manufactured by the E. W. Bliss Company, Brooklyn Borough, New York. The adjustment for different diameters is made by simply turning the hand-wheel, and that for the different numbers of notches is effected by means of change gears instead of the usual pawl and index-plate device. The same set of gears can in most cases be arranged to answer for three different numbers of notches, so that 10 change gears, for instance, may be used for 10 different divisions. Index feed is effected by means of a "Geneva stop movement." An absolutely correct indexing is further assured, however, by the use of a positive cam-actuated locking device for the indexing arbor.

An automatic stop is provided, which throws out the clutch (thereby stopping the press) as soon as the disk has made one complete



ARMATURE DISK-NOTCHING PRESS.

revolution. By the use of this stop it is possible for one operator to attend to several presses. A spring stripper is used in connection with the punches, so as to leave a clear space over the die, making it easier to introduce a new disk, and holding the disk under pressure while being punched.

Unless otherwise ordered the presses are furnished with a removable clamping arm (shown in the figure), which carries a device enabling the operator by a single movement of the hand-lever to do the clamping.

The principal features of these presses may be enumerated as follows: Great speed, absolutely correct indexing, great range of indexing and ease of adjustment for different sizes of disks.

Mica in the Philippines.

According to the *Oil, Paint, and Drug Reporter,* Filipinos living in the hill country of Panay and Negros during recent years have devoted considerable attention to the mining of mica, and a considerable output of good quality has been secured. It has been worked by modern machinery of Spanish design, and large quantities are transported to the coast for export. Another important mining industry that can readily be developed in these islands is quicksilver, as this material is found in Mindanao and the other islands of the southern archipelago.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—In the money market there is an evident increase in conservatism on the part of lenders, and a consequent decrease in supply. In the open market, call loans ranged from 4 to 6 per cent, the bulk of the business being done at 5½. Time money was offered with decreased liberality, although the inquiry has fallen off to some extent. The quotations are 5@5½ per cent for 30 to 60 days, and 5 per cent for longer periods. The supply of mercantile paper is not large, and the demand is limited, coming almost entirely from out of town. In the stock market there was an active speculation of a professional character. The firmness of money and the approach of the end of the business year have apparently checked public interest in the market. In the traction group, Brooklyn Rapid Transit was the most active feature, the activity being due largely to the favorable impression made by the company's annual report. The closing quotation was 5⅛ points higher than the final price the week before, and the number of shares sold was 154,953. The other tractions and all of the electric stocks were strong, all closing with substantial net gains—Metropolitan Street Railway 3¾, General Electric 2 points, and Western Union 3⅛. The market for outside securities was irregular, and, generally speaking, transactions were on a diminished scale. In the electrics, Electric Boat received special attention, both common and preferred closing with substantial advances. Electric Vehicle, with other industrials, were under some pressure and closed with a net loss. Following are the closing quotations:

NEW YORK.

	Dec. 8.	Dec. 15.		Dec. 8.	Dec. 15.
Gen. Electric	169¾	171¾	Elec. Veh.	19	17
Bklyn. Rap. Tran.	70⅜	75½	Elec. Veh., pfd.	36	35
Met. St. Ry.	165	168¾	Gen. Car	4¾	4⅞
Am. Tel. & C.	—	—	Ill. Elec. Veh. Tran.	1	1
West. Un. Tel.	82	85⅛	N.Y. Elec. Veh. Tran.	6½	6½
Am. Dist. Tel.	35¼	36½	N.E. Elec. Veh. Tran.	3½	—
Com. Cable	—	—	Tel. & Tel. Co. of Am.	3	3⅛
Elec. Boat	22¾	26½	Hud. Riv. Tel.	116	115
Elec. Boat, pfd.	38	46½	N. Y. & N. J. Tel.	150	168

BOSTON.

	Dec. 8.	Dec. 15.		Dec. 8.	Dec. 15.
New Eng. Tel.	—	—	Erie Tel.	104¼	102
Mex. Tel.	2¼	2¼	Gen. Elec., pfd.	143	—
Westing. Elec.	51½	54¼	Am. Tel. & Tel.	154	156½
Westing. Elec., pfd.	—	—	Ed. Elec. Lt.	—	—

PHILADELPHIA.

	Dec. 8.	Dec. 15.		Dec. 8.	Dec. 15.
Elec. Stor. Bat.	88	85	Phil. Elec.	4½	4¾
Elec. Stor. Bat., pfd.	94	85	Pa. Elec. Veh.	4	—
Elec. Co. of Am.	8⅝	8⅞	Pa. Elec. Veh., pfd.	1½	—
Gen. Elec. Auto	¼	¼	Am. Rys.	35¼	34¼

CHICAGO.

	Dec. 8.	Dec. 15.		Dec. 8.	Dec. 15.
Chicago Edison	142	147	Chicago Telep. Co.	235	235
Chic. City Ry.	255	255	Union Traction	12½	9½
Nat'l Carbon	16½	16½	Union Traction, pfd.	54½	42½
Nat'l Carbon, pfd.	84½	83	Northwest Elev. Com.	28	29¼

DIVIDENDS.—The United Traction & Electric Company of New Jersey has declared a dividend of 1 per cent, payable Jan. 2. The directors of the Westinghouse Electric & Manufacturing Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Jan. 2. The directors of the Otis Elevator Company have declared a quarterly dividend of $1.50 per share upon the preferred stock of the company, payable on and after Jan. 12, 1901, The directors of Western Union have declared the regular quarterly divident of 1¼ per cent, payable Jan. 15. The Twin City Rapid Transit Company has declared a quarterly dividend of 1¾ per cent on its preferred stock, payable Jan. 2. The Westinghouse Machine Company has declared a quarterly dividend of 1½ per cent on the preferred stock, and a dividend of 1½ per cent on the common stock. The Union Switch & Signal Company has declared a dividend of 2 per cent on the preferred stock and a dividend of 1 per cent on the common stock, payable Jan. 10. The Niles-Bement-Pond Company has declared 1½ per cent on its common stock, payable Dec. 20. The United Gas Improvement Company has declared a quarterly dividend of 2 per cent, payable Jan. 15. The executive committee of the Nassau Electric Railroad Company, Brooklyn, N. Y., has recommended to the directors the payment of a dividend of 4 per cent on preferred stock, payable Dec. 31. No dividend was ever paid on this stock under the old management, and before the lease was acquired by the Brooklyn Rapid Transit Company, and this will be the first dividend the holders of this stock have received. The Washburn Wire Company has declared a dividend of $1.75 per share on the preferred stock, payable Jan. 1, 1901, being at the rate of 7 per cent per annum for the three months from Oct. 1, 1900, to Jan. 1, 1901. The Metropolitan Street Railway Company, N. Y., has declared the regular quarterly dividend of 1¾ per cent.

WESTERN UNION has been showing strength lately and a bullish feeling is beginning to be shown on the stock. It appears to be based on something outside of the regular business of the company, although no information is given as to what this may be. Western Union is not particularly dear, says the *Wall Street Journal*, regardless of any special developments. The company has been able to pay 5 per cent without interruption and it seems likely to continue that rate of dividend for some time to come. Nobody doubts the ability of Western Union to pay 4 per cent and show a substantial surplus. If it were paying 4 per cent, keeping up the property and carrying half a million dollars a year to surplus account, the stock would be likely to sell as high as it is now. It therefore seems to be a case where the price might advance on any change for the better with the chances against much decline. Efforts to depress the price have seldom succeeded in getting the quotation below 78 in the last few years. The net earnings for the quarter are put at $1,700,000, and net surplus for the period, after dividend, of $243,960. The actual net revenues for the quarter ended Sept. 30 were $1,705,755; bond interest took $239,040 and dividends $1,217,001, leaving a surplus for the quarter of $249,714.

MEXICAN TELEPHONE.—The financial statement of the Mexican Telephone Company for September and for the seven months is the best ever issued by the company. The increase in the net earnings of $10,633 for the seven months ended Sept. 30 is but $315 less than the total net increase for the whole of the last fiscal year ended Feb. 28. It is the opinion of the officials that at the present rate of increase the company for its fiscal year ended Feb. 28, 1901, will show net earnings of $75,000 Mexican currency, compared with $67,388 for the last fiscal year. The company last year spent out of earnings $34,333 for new construction, leaving a cash surplus of $26,519 (gold) or 1.4 per cent on the 180,871 shares of stock outstanding. For the current year it is expected that about $50,000 will be expended for new construction, of which $41,254 has already been spent. The company has now practically completed all the new construction that has been necessary upon the plant for years, and the surplus of the company in the near future will be correspondingly increased. The company has about 19,000 shares of stock in its treasury. The cash surplus carried over from last year has been expended for new construction, leaving a cash surplus on its books of about $22,000 gold.

AMERICAN TELEPHONE.—The election of Mr. Chas. P. Bowditch to the directorate of the American Telephone & Telegraph Company is regarded in Boston as a continuation of the conservative policy that has heretofore prevailed in the management of that property. The vacancy in the directorate caused by the death of President Hudson was not expected to be filled until a permanent president was selected who would also fill the vacancy on the board. The election of Mr. Bowditch would indicate that a permanent president will be chosen from the present directorate, as otherwise it would be necessary to ask the stockholders to change the by-laws, enlarging the board. Indications are that Mr. Cochrane will continue as acting president. It has been rumored that when Governor Crane retires from the governorship of Massachusetts he will take the presidency of the company. While Mr. Crane is the largest stockholder in the company, he has never been officially connected with it, although often conferred with regarding matters of general policy.

INCREASE OF WESTINGHOUSE STOCK.—The Westinghouse Electric & Manufacturing ompany has called a meeting of shareholders for Feb. 20. The company announces officially that the meeting is called on the recommendation of President George Westinghouse, who in a letter to the directors advised an increase of capital stock in view of the approaching completion of new buildings at East Pittsburg, the necessity of providing for investments heretofore made and others that might still be required to take care of the growing trade. The present capitalization is $15,000,000. The board of directors will meet before the stockholders' meeting to recommend the amount of the proposed increase of capital. The Westinghouse Company is crowded to overflowing with new business and orders.

WESTCHESTER MORTGAGE.—The Westchester Lighting Company has filed a mortgage in favor of the Colonial Trust Company, of Manhattan Borough, for $10,000,000. It is to cover the issue of first mortgage 5 per cent 50-year gold bonds.

BROOKLYN, N. Y.—Additional stock of the Kings County Electric Light & Power Company has been listed on the New York Stock Exchange, amounting to $520,000, making the total amount listed $2,500,000.

GENERAL ELECTRIC.—During the present year the volume of gross business, the gross receipts and the percentage of returns upon the share capital have been the largest in the history of the organization. The gross receipts this year will be considerably above $30,000,000 as contrasted with below $23,000,000 last year, and below $17,000,000 two years ago. Nearly 14,000 names are now on the payroll of the company. This year the company will be able to show $6,000,000 of net earnings on a reduced capital. Except for the conversion of most of the $5,000,000 bonds into common stock, which will probably take place this month, the company would show more than 30 per cent upon its $18,276,000 common share capital outstanding until recent date. Upon the share capital increased by the conversion of its bonds into common stock, earnings of about 25 per cent will probably be shown. Shipments this year have, in some months, almost touched the $3,000,000 mark. During the past five years the General Electric Company has written off $6,420,000, four-fifths of which has been written off against current profits. As the common stock of the company now represents about the available working capital, there is absolutely no further room for write-offs against depreciation, unless it is proposed to write off the entire factory plants, patents, franchises and good will, the total of which, at the beginning of the year, stood at $5,400,000.

UNITED GAS IMPROVEMENT.—The trolley lines connecting New York and Bridgeport, Conn., recently acquired by the United Gas Improvement Company, have been consolidated and arrangements have been made with prominent bankers to put out an issue of bonds on the united system. The issue will probably be $10,000,000 and will bear 4½ per cent interest. It is understood that the Seligmans, of New York, are the bankers to whom the bonds have been sold. The name of the corporation under which the various systems are united is stated to be the Connecticut & Western Railway Company.

TELEPHONE EXTENSIONS IN PITTSBURG.—The board of directors of the Central District & Printing Telegraph Company of this city has decided upon the expenditure of $3,000,000 for improvements and betterments upon their system of telephones and substations in this district. Of this amount a part will be used for the erection of two sub-stations in Ohio and for the remodeling of the East End sub-station in the city of Pittsburg.

DETROIT RAILWAYS.—The street railways of Detroit have again been reorganized under a new consolidation, which will be known as the Detroit United Railway Company, with a capital of $12,500,000. Henry A. Everett, of Cleveland, and his friends will control 40 per cent of the stock. The deal was arranged in New York a few weeks ago at a conference of the principal stock holders of the corporations.

BROOKLYN RAPID TRANSIT.—The annual report of Brooklyn Rapid Transit for the fiscal year ended June 30 was made public last week. The report of President C. L. Rossiter showed that the operating expenses of the road for the year ending June 30 were $7,194,237, against $7,313,647 for 1899. The report shows a surplus of $734,469 and the property would appear to be improving apace.

MILWAUKEE, WIS.—The capital stock of the Milwaukee Street Railway is to be increased from $3,000,000 to $15,000,000, for the purpose of making general improvements and the building of a new power house.

CHICAGO.—The Chicago City Railway will issue early next year, it is understood, new stock at par to shareholders and the dividend rate will probably be decreased from 12 per cent to 8 per cent.

Commercial Intelligence.

THE WEEK IN TRADE.—Reports to the mercantile agencies point to the existence, generally, of favorable trade conditions in seasonable lines. The leading industries also make favorable reports, especially the iron and steel trade, and finished products in the latter lines continue to hold a high place in point of activity. There is no apparent diminution of strength in the iron and steel market, and the actual transactions in rails and plates compare well with the best on record. In retail trade, holiday business of course occupies the greatest attention, and gratifying reports come from all sections of the country. Small crop yields in the Northwest have cut down gains in railway earnings as a whole, but in spite of this the total earnings of 107 roads aggregate $60,728,575, a gain of 2 per cent over November a year ago, the fifth successive gain shown in November for five years past. The best returns are those made by the Southwestern, the soft-coal and the Central Western lines, while the spring wheat carriers show decreases. The earnings of 107 roads for 11 months aggregate $619,470,469, a gain of nearly 10 per cent over a year ago. This likewise follows successive gains in every year since 1896. The number of business failures during the week, as reported by *Bradstreets'*, was 247, as against 224 the week before and 234 the same week in 1898. In the metal market, copper was very quiet, only very small and scattered transactions being reported. The tone of the market is considerably easier, and there are evidences of weakness. Quotations are 17c. for lake and 16⅝c. for electrolytic and casting.

EXPORTS AND IMPORTS.—A volume is being prepared by the Bureau of Statistics of the Treasury Department showing the exports and imports of practically the whole world. The commerce of 47 countries other than the United States is pictured in the opening tables of the proposed volume. Of this number, 18 countries show an excess of exports over imports, and 29 show an excess of imports over exports. The principal countries which show an excess of exports over imports are Canada, Mexico, Argentina, Chili, Australasia, India, Egypt, Spain, Austria-Hungary and Russia. A study of the detailed figures in this group of various countries whose exports exceed their imports, and a comparison of their imports and exports with those of the United States alone furnishes a striking evidence of the phenomenal prosperity of our own country. No one of the 18 countries whose exports exceed imports shows a favorable balance of trade approaching that enjoyed by the United States, and a compilation of the excess of exports in the entire group of 18 countries having such excess gives a grand total of only $414, 845,000, in the latest attainable year, as against an excess of $544,542,131 in favor of the United States alone in the fiscal year 1900.

AMERICAN BICYCLE COMPANY announces that it has acquired the rights to the storage battery recently used by Mr. Elmer E. Sperry in his automobile work, as well as to some of his other patents in the same field. His "system" has been described in the pages of ELECTRICAL WORLD AND ENGINEER. Mr. R. L. Coleman, president, says: "The ordinary battery gives 2¼ ampere-hours per pound. The Sperry battery gives 7.85 ampere-hours per pound; more than three times the quantity. The Sperry battery gives the same energy as other batteries for 28.690 of their weight, which is to say, that weighing but 28.690 of the total weight of the old battery, the Sperry will give exactly the same results." The Sperry automobile patents have hitherto been in the hands of the Cleveland Machine Screw Company, which has been understood to represent French capital. Mr. Sperry has been appointed chief electrical engineer to the American Bicycle Company.

ARGENTINE REPUBLIC.—At Corrientes, Argentine Republic, the municipal council is considering a proposal to erect electric power works. As most of the electrical undertakings in that republic use a great deal of American-made machinery and material, the contract for the Corrientes plant may be secured by some of the United States electrical engineering firms if the proper efforts are made. The outlook in the Argentine Republic for other machinery is reported by the Bureau of American Republics to be bright. Each month there appear to be inquiries for tools and machinery. The growth of trade in railroad supplies and manufactured iron and steel, from exporters' point of view, is highly satisfactory.

TELEPHONE OUTPUT.—The American Telephone instrument statement for the month ended Nov. 20 shows:

	1900.	1899.	1898.	1897.
Gross output.....	52,208	69,117	35,159	29,023
Returned	36,412	19,992	15,486	7,817
Net output.....	15,796	49,125	19,673	21,206
Since Dec. 20—				
Gross output.....	576,570	608,715	313,522	214,897
Returned	257,110	183,263	135,568	84,068
Net output.....	319,460	425,452	177,954	130,829
Total outstanding.....	1,899,965	1,550,702	1,097,475	904,678

MEXICAN WATER POWERS.—In the State of Puebla, Señor Don B. Arias has a concession to utilize for motive power 1500 litres of water per second from the River Baltasar. Señor Miguel Bringas has been authorized by the Mexican Government to use the waters of the Blanco River, in the State of Veracruz, for the purpose of generating electric power and for irrigation purposes.

PLANT FOR NORTH CAROLINA.—The Shelby Light & Power Company, Shelby, N. C., has been incorporated. The contract for the machinery and construction has been awarded to Mr. J. E. Duval, Southeastern agent for the Royal Electric Company, of Peoria, Ill.

RAILWAY TIES.—The Saginaw Suburban Railway Company has closed a contract with the Maltby Lumber Company, of Bay City, for 100,000 ties to be used in the construction of the road between Bay City and Flint. The contract calls for the delivery of the ties at points along the line where needed.

WESTERN OHIO RAILWAY COMPANY.—This company has just begun building its line, but has not as yet placed any order for machinery. It has not decided where to place its contracts. Mr. F. D. Carpenter, Lima, Ohio, is the general manager.

SPRAGUE ORDER.—A large order has just been closed with the Sprague Electric Company for some 20-hp motors of the slow-speed direct connected type to operate the new plant of the Delaware Button Company at Wilmington, Del.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material and kindred lines from the port of New York for the week ended Nov. 30: Antwerp—25 packages electrical material, $1,728; 1 case electric machinery, $127. Amsterdam—1 case electrical material, $200. Argentine Republic—48 cases electrical material, $3,008; 1 case electric machinery, $297 Brazil—82 cases electrical material, $4,244. British West Indies—11 cases electrical material, $140. Bremen—14 packages electrical material, $842. British Possessions in Africa—25 cases electrical material, $884. Central America—40 packages electrical material, $773. Christiania—2 cases electrical material, $25. Chili—25 cases electrical material, $505. Cuba—24 packages electrical material, $1,058; 60 packages electric machinery, $11,296. Dutch West Indies—17 packages electrical material, $502. Dresden—2 cases electric machinery $75. Ecuador—10 packages electrical material, $186. Genoa—214 packages electrical material, $47,872. Glasgow—5 cases electric machinery, $365; 6 cases electrical material, $2,000. Havre—38 packages electrical material, $3,107. Hamburg—7 cases electric machinery, $3,255. Hayti—2 cases electric machinery, $45; 20 packages electrical material, $1,850. Hong Kong—189 cases electrical material, $6,633. Japan—52 cases electric machinery, $22,825; 19 cases electrical material, $882. Leeds—2 cases electrical material, $60. London—138 packages electric machinery, $11,645; 78 packages electrical material, $3,327. Liverpool—88 packages electric machinery, $14,428; 50 packages electrical material, $3,561; 2 packages motor trucks, $175; 62 electric cables, $25,075. Mexico—112 packages electrical material, $11,351; 5 cases electric machinery, $187. Marseilles—20 cases electrical material, $1,860. Manchester—6 packages electrical material, $690. Milan—41 cases electrical material, $5,127. Newcastle—33 cases electric machinery, $3,750; 18 cases electrical material, $4,080. New Zealand—1 case electrical material, $71. Naples—40 packages electrical material, $560. Oporto—1 package electrical material, $70. Porto Rico—57 packages electrical material, $1,604. Peru—2 cases electrical material, $33; 50 packages electric machinery $1,390. Reval—48 cases electric machinery, $516. Riga—17 packages electrical material, $3,403. Southampton—80 cases electrical material $5,147; 27 packages electric machinery, $1,517. St. Petersburg—1 case electric machinery, $1,300; electrical material, $906. U. S. of Colombia—50 packages electrical material, $1,230. Vienna—11 cases electric machinery, $1,608. The following were the exports for the week ended Dec. 5: Antwerp—27 packages electric material, $1,681. Argentine Republic—142 cases electric material, $3,535; 59 cases electric machinery, $4,995. British Australia—8 cases electric machinery, $410. Brazil—86 cases electric material, $2,830; 14 cases electric machinery, $3,451. British Guiana—55 packages electric material, $1,444. British West Indies—2 packages electric material, $160. Bristol—4 cases electric machinery, $500. Central America—25 cases electric material, $675; 9 cases electric machinery, $278. Copenhagen—1 case electric machinery, $115. Chili—24 packages electric material, $616. Cuba—430 packages electric railing material, $10,980; 51 packages electric material, $1,650; 13 packages electric machinery, $3,740. Danish West Indies—5 packages electric material, $52. Ecuador—7 cases electric material, $257. Havre—3 packages electric machinery, $145; 222 packages electric material, $20,008; 2 packages motor vehicle material, $443; 4 packages motor material, $200. London—162 cases electric machinery, $5,520; 209 packages electric material, $31,978. Liverpool—45 packages electric machinery, $4,000; 17 packages electric material, $2,622. Leeds—10 packages electric material, $120. Newfoundland—25 packages electric material, $277. Nova Scotia—11 packages electric material, $149; 3 boxes electric machinery, $125. Porto Rico—18 cases electric material, $228; 1 package electric machinery, $26. Peru—8 packages electric material, $167; 26 cases electric machinery, $1,160. Southampton—11 cases electric machinery, $524; 5 cases electric material, $1,291. San Domingo—118 cases electric material, $2,589. Trieste—1 case electric material, $90. Venezuela—32 cases electric material, $102; 1 case electros, $74.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, Ohio, which has achieved such a gratifying success with its direct-current dynamos and motors, has recently resolved upon a step of considerable importance to itself and the electrical industry. Steps are now being taken by President Bullock with wonted vigor to equip the fine factory at Norwood, Ohio, with additional machinery, and so forth, for the production of alternating current apparatus, and already contracts have been taken to install some large power transmission plants. This might seem rather precipitate were it not for the fact that the company will build this new class of machinery under an arrangement with the Oerlikon Company, of Switzerland, which has an international reputation for the excellence of its alternating work. It is understood that one of the engineers of the Oerlikon Company is now in this country to supervise the construction of some of the first machines, and that Mr. Bullock has secured the technical services of Mr. B. A. Behrend, who was at one time a prominent member of the Oerlikon staff, but has been in this country more recently.

BALL ENGINE AT PARIS.—The following letter has been received by Vice-President McBrier, of the Ball Engine Company, from Mr. F. E. Drake, director of machinery and electricity for the United States Paris Exposition Commission: "The end of the Exposition having arrived, I feel it my duty and privilege to inform you, officially, concerning the operation of the 300-hp tandem compound engine which you supplied this department for the operation of the power generator at the United States Machinery Building at Vincennes. Our plant was the first of the entire Exposition to be put in active service, and since the starting of your engine we have never had a moment's shut down or the least difficulty which could in any way be traceable to your engine. It has operated noiselessly and continuously and has made many friends among the foreigners who have visited the plant. I must congratulate you upon the workmanship and execution, in all directions, of the engine, as was evidenced by the fact that we procured for you at the hands of the International Jury of Awards a gold medal, which is an exceedingly high honor for an engine of this size and class."

SOUTHERN ELECTRICAL WORK.—A great deal of activity is reported down South in electrical work. The city of Crowley, La., has just purchased one 100-kw A. C. Fort Wayne generator for lighting. The Laurel Electric Light & Power Company, Laurel, Miss., has purchased one 60 and one 90-kw A. C. generator from the General Electric Company. The city of Ruston, La., has bought one 75-kw A. C. generator from the Westinghouse Electric & Manufacturing Company. The Boyce Light, Ice & W. W. Company, Boyce, La., has purchased a 50-kw General Electric generator. The Manhattan General Construction Company has closed orders for 50 series A. C. arc lamps for the city of New Iberia, La., and 30 220-volt D. C. arc lamps for Ruston, La. It is rumored that a large power plant of about 10,000-hp capacity will, in the near future, be installed in the neighborhood of Crowley, La., to operate the various irrigating plants by electrical power, thereby doing away with the steam pumping plants now in use in that section of the country.

THE STOREY GENERAL ELECTRIC COMPANY, successors to the Storey Motor & Tool Company, has just completed the removal of its offices and factory from Trenton, N. J., to a larger and newly equipped factory at Harrison, N. J. The new company, which is capitalized at $3,500,000, is the outgrowth of the steadily increasing demand for the well-known Storey motors, and, with the larger facilities in shop room, machinery, etc., which are at its disposal, it will soon be in a position to handle a much greater volume of work in the same lines as those previously followed, as well as to take up a number of additional lines which it was impossible to handle before on account of the lack of facilities. Mr. I. E. Storey, the former proprietor of the Storey Motor & Tool Company, is president of the new concern, and has associated with him men who have both the ability and capital to push the new company.

THE MAXWELL M. MAYER ELECTRIC COMPANY, 2365 Second Avenue, New York, reports business having picked up considerably in the last few months. Among its recent sales are large plating dynamos to the Electro-Chemical Engraving Company, of Long Island City, and the Stanley Rule & Level Company, of New Britain Conn.; a 50-light dynamo to the Anderson Forging Company, of Anderson, Ind.; a 1-hp motor to B. Mayer Optical Works, Baltimore; a 50-light dynamo to South America and a shipment of various sizes of motors to England.

THE STURTEVANT ENGINEERING COMPANY has recently moved its London, Eng., office to 147 Queen Victoria Street, that city, in order to secure the increased accommodation necessary for its rapidly growing business as the European representatives of the B. F. Sturtevant Company, of Boston, Mass. A new branch office has been established at 31 Rue de Provence, Paris, and a change made in the location of the Glasgow office to 45 Hope Street. The offices at Berlin, Stockholm, Amsterdam and Milan remain as before.

WASHINGTON, D. C.—The contract for engines and generators for the new plant of the Government Printing Office has been let to E. P. Allis & Company, of Milwaukee, Wis. The Allis contract specifies two Crocker-Wheeler generators of 600 kilowatts each, 125 volts at 100 r. p. m., direct connected to cross-compound horizontal Corliss engines. In the old plant are now located one 150-kw and one 300-kw 125-volt at 150 r. p. m. Crocker-Wheeler generators and motors aggregating over 1000 horse-power.

MR. CLINTON E. WOODS, the electrical engineer, etc., whose name is well known in the automobile field, has established a new automobile industry in Chicago, and is introducing a line of handsome vehicles. They embody several new features and improvements.

MR. EDWARD LYON, 138 West 116th Street, New York City, has been appointed agent here for the Strong & Rogers electric automobiles, and has orders in for several vehicles.

General News.

THE TELEPHONE.

OPELOUSAS, LA.—The Cumberland Telephone & Telegraph Company will establish an exchange here.

ALTON, ILL.—The Kinloch Telephone Company has asked the City Council for a franchise in this city.

INDIANAPOLIS, IND.—Bills to reduce the rates charged for telegraph and telephone service are being prepared for the Legislature.

CENTREVILLE, MO.—The Reynolds County Telephone Company, capital stock $1,000, has been incorporated. Incorporators are J. T. Dobbins, J. F. Rayfield, Wm. Rayfield and others.

KANSAS CITY, MO.—The El Dorado Springs Telephone Company has been incorporated, with a capital stock of $10,000. Incorporators: C. A. Ross, Frank W. Hiatt, A. P. Nichols and others.

CHATTANOOGA, TENN.—A company is being formed, with Thomas S. Wilcox, president; Sam Erwin, manager, and J. B. Whitehead, secretary-treasurer, for the construction of a telephone system.

LOGANSPORT, IND.—S. P. Sherin, vice-president of the Indianapolis Telephone Company, has stated that he will shortly petition for a franchise to operate a telephone exchange in this city.

COLUMBUS, OHIO.—The Farmers' & Merchants' Telephone Company, of Warsaw, Coshocton County, has increased its capital stock from $5,000 to $15,000. A number of improvements are being planned.

CALDWELL, OHIO.—The Caldwell Independent Telephone Company, which was recently incorporated, began business in May, 1894. It has 20 miles of local circuits, 92 miles of toll line and 51 subscribers.

JACKSON, MICH.—Manager J. W. Martin, of the Oakland Telephone Company has been granted a franchise for a new system in Jackson and in Macomb County. A franchise has been asked for in Mt. Clemens.

MADISON, WIS.—Mr. C. E. Nestor, general contract agent of the Erie Telephone Company, is organizing a corps of assistants, who will make a complete canvass of the city for the enlargement of the Erie system.

PENVILLE, IND.—A new telephone company has been organized in this city and filed articles of incorporation. The company will establish an exchange here. F. E. Mayer and W. H. Hall are president and secretary, respectively.

LOGANSPORT, IND.—The two telephone companies asking for franchises in this city keep the agitation at fever heat. Several mass meetings have been held and no less than an established rate of $12 per annum for residences and $18 for business houses will satisfy the people.

ZANESVILLE, OHIO.—The United States Telephone Company, of Cleveland, has completed its through long distance line from Cleveland to this place. The company had great difficulty in securing a local franchise and finally entered the city without one, using the poles of the Zanesville Telephone & Telegraph Company.

DANA, IND.—The Chanee & Fair Electric Company, of Chrisman, Ill., which owned the telephone plant here, has sold the controlling interest to Ed. Vansickle, of Hillsdale. The latter has formed a company with $13,500 capital, and will incorporate under the name of the Indiana Electric Company, with headquarters at Dana.

MERRILL, WIS.—The Merrill Telephone Company has experienced a prosperous year, having gained 125 subscribers in that time. It now has 300 subscribers, which is the limit of its switchboard capacity. The company contemplates stringing one mile of overhead cable and increasing its switchboard capacity.

CANTON, OHIO.—The Stark County Telephone Company has been granted a 25-year franchise for a local exchange. Under the terms the rates are to be $18 for residences and $24 for business; free service to be given throughout the county and the company to forfeit a $15,000-bond in case it sells out to a rival company.

ROCKWELL CITY, IA.—The Central Telephone Company is operating four exchanges—at Lake City, Rockwell City, Manson and Pomeroy—having a total switchboard capacity of 810 drops. The total number of subscribers is 300. During the past season the company built 40 miles of toll lines and installed the exchange at Pomeroy.

GOSHEN, IND.—The Home Telephone Company, of Elkhart County, has decided to construct a full metallic line from this city to Milford, there to connect with the Warsaw Independent Telephone Company's line, recently purchased by Strauss & Company, of Ligonier, which firm proposes to construct a direct independent line to Indianapolis.

AUSTIN, TEXAS.—It is stated here that the National Advisory Board of the Electrical Workers' Union will order a strike of all the members of the order in the employ of the Erie Telephone system in sympathy for the strike of the employees of the Southwestern Telegraph & Telephone Company in Texas, waich is a part of the Erie system.

DETROIT, MICH.—A faint idea of the extent of the wilderness of Michigan may be obtained from the fact that the town of Michipicoton is two days' travel from the nearest point of communication. This place, however, is to be brought into connection with the outside world by a telegraph line, which is now being built along the route of the Algoma Central Railroad.

ALLIANCE, OHIO.—The Columbiana County Telephone Company and S. C. Thayer have again been defeated in their efforts to secure a franchise for a local exchange. Five councilmen who posed as its friends and whose votes would have secured the franchise, slipped out of the Council meeting just before the vote was taken, leaving the field clear to the partisans of the Bell Company.

TOLEDO, OHIO.—The values of telephone and telegraph properties in Toledo, according to the report recently made by the county treasurer, are as follows: Central Union Telephone Company, $341,230; Harrison Telephone Company, $18,000; Western Union Telegraph Company, $23,120; Postal Telegraph & Cable Company, $2,130; Ohio Telephone & Telegraph Company, $1,100.

HARRISON, OHIO.—The Village Council has granted a 20-year franchise to the newly organized Harrison Telephone & Exchange Company. The company is building an extensive farmers' system in Butler and Hamilton counties, embracing the villages of Okeana, New London, Venice, New Baltimore, Elizabethtown, Miamitown and Cleves. R. C Crampton, formerly with the Central Union Telephone Company, is manager.

ST. LOUIS, MO.—The Police Department has placed on test in one district of the city new telephone boxes. The test has proven so successful that the boxes will be placed throughout the city. Two keys and two keyholes are needed. When the key is inserted in the top keyhole a call is sent out for the patrol wagon and for help, and by the same operation the time, station and call are registered. The lower keyhole opens the box and permits telephoning.

APPLETON, WIS.—The newly organized Fox River Valley Telephone Company, which is now building toll lines to connect Appleton, Neenah and Kaukauna with the toll service of the Little Wolf River Telephone Company, and which will, in the spring, establish local exchanges at the intermediate towns, is also contemplating extending the toll service to Seymour. Both these projects will be decided upon at the annual meeting of the company here in January.

MANSFIELD, OHIO.—The Star Telephone Company will shortly open its exchange in this place. The company has over 400 subscribers among the farmers of this county and has 21 toll stations in operation. The exchange will open with about 100 local subscribers. Rates will be $1.50 per month for residences and $2 for business houses. Service will be given throughout the county free of charge. The Star Company operates in Richland, Ashland, Medina, Holmes, Morrow and Lorain counties, and is one of the most prosperous companies in Ohio.

CHAGRIN FALLS, OHIO.—The Chagrin Falls Telephone Company, with $15,000 capital stock, has been incorporated by C. H. Hubbell, F. P. Shumaker, William D. Brewster, I. W. Hutchinson and L. S. Hubbell. The company will construct a telephone exchange in Chagrin Falls, with farmers' lines and branch exchanges in the following townships: Warrensville, Bedford, Northfield, Russell, Bainbridge, Twinsburg, Chester, Aurora, Newberry and Auburn. The company will connect with the Geauga County Association of farmers' exchanges and with the United States Telephone Company.

SAN FRANCISCO, CALIF.—The Sunset Telephone Company recently purchased a piece of property in this city. It is said that the price paid was nearly $100,000. It is the purpose of the telephone officials to erect a four-story, fireproof building for the use of the company, the walls being heavy enough for an additional four stories. A three-story factory building will be erected in the rear of the larger one to accommodate the company's large manufacturing business. The Telephone Building, at 216 Bush Street, will be reserved for use as a central exchange. The company now employs about 150 boys and men at manufacturing telephone apparatus, including switchboards, etc.

ELECTRIC LIGHT AND POWER.

JONESBORO, GA.—The city contemplates the erection of an electric light plant.

DILLON. S. C.—The city contemplates the installation of a complete system of electric lights.

FAYETTEVILLE, N. C.—The city will issue bonds for erection of a municipal electric light plant.

PORT ARTHUR, TEX.—A franchise has been granted to Charles Gates for an electric light plant.

CROWLEY, LA.—The city has purchased and will enlarge the electric light plant of Henry Widmer.

LAURENS, S. C.—The Laurens Furniture Manufacturing Company will install an electric light plant.

THOMASVILLE, GA.—The electric light plant at this place has been sold to Robert Gamble for $15,800

PEORIA, ILL.—The Peoria Gas & Electric Company is to increase its capital stock from $500,000 to $1,000,000.

JASPER, FLA.—B. E. Lennard, C. W. Smith, W. H. Greene and M. F. Home will establish an electric light plant here.

PLANO, ILL.—The Plano Electric Light & Power Company has changed its name to the Plano Heat, Light & Power Company.

CHARLESTON, W. VA.—The Boise-Fayette River Electric Power Company, of Idaho, has been incorporated in this State, with a capital of $1,000,000.

ST. CLAIRVILLE, OHIO.—The County Commissioners are considering the installation of an independent electric light plant to light the county buildings.

MARION, IND.—The Union Traction Company is preparing to furnish electric light to the various towns along its lines, from its central power station at Anderson.

DOVER, DEL.—The United Light & Power Company, of New York, has been incorporated in this State to furnish electric light, gas and power. Capital, $1,500,000.

TERRE HAUTE, IND.—The trustees of the State Normal School of this city will ask the Legislature for an appropriation to construct an electric light plant for the school buildings.

INDIANAPOLIS, IND.—Custodian Vest, of the Indiana State Capitol, will recommend that the Legislature provide means to construct an independent electric light plant for the building.

RICHMOND, IND.—Plans and specifications for the new electric light plant for this city have been accepted by the City Council and bids advertised for. The contract will be let Jan. 3, 1901.

BERLIN, WIS.—The Berlin Lighting, Heating & Power Company has been incorporated, with a capital of $65,000. The incorporators are B. Odell, C. A. Peck and R. A. Christe, all of this city.

WEST PLAINS, MO.—The contract for the installation of water works and electric light plants for the city has been awarded to the Southern Engineering Company, of St. Louis, for $25,119.

LORAIN, OHIO.—The new illuminating and power plant recently completed by the Westinghouse Electric & Manufacturing Company for the Lorain Gas Company has been put into operation.

CROSSVILLE, TENN.—The Crossville Electric Light & Power Company has been incorporated, with J. E. Burnett, president; W. S. De Golia, vice-president; J. A. Johnson, treasurer, and O. W. Monroe, secretary.

WALLA WALLA, WASH.—The Walla Walla Gas & Electric Company recently borrowed $100,000 for the purpose of paying off its indebtedness and also to pay for extensions of its electric lighting system and gas plant.

OTTAWA, ONT.—The Power & Light Company, of West Kootenay, B. C., purposes increasing the capacity of its plant at Bonnington by 10,000 horse-power. The cost of the new works is estimated at $1,000,000.

PITTSBURG, PA.—A short circuit on electric light wires in Wilkinsburg, a suburb of this city, burned out 100 telephones of the Federal Telephone Company, besides throwing a part of the borough into darkness for one night.

ST. CHARLES, MO.—Work has commenced in the construction of an eighty-ton electric transfer table in the American Car & Foundry Company's plant. The work is being done by the Industrial Works, of Bay City, Mich.

OMAHA, NEB.—The Bluffs City Electric Light Company has absorbed the Council Bluffs Electric Light & Gas Company. The sale includes the pole lines, wire system and power plant and lighting franchise, but not the gas plant.

OTTAWA, ONT.—The Central Electric Company, of Portage la Prairie, Manitoba, has just been installed and put in operation a 150-kw, S. K. C., two-phase alternator. The company contemplates going into the power business.

SAN FRANCISCO, CALIF.—The city attorney of San Francisco recently rendered an opinion that the department of electricity of this city was not empowered, under the new charter, to receive bids for electric supplies and materials.

BARBERTON, OHIO.—The lighting contract with the Northern Ohio Traction Company has expired and the city has called for bids for lighting the village with arc lights. A franchise will be granted to a new company. Bids will be opened Dec. 24.

PITTSBURG, PA.—The contract for the electric wiring and fixtures for the new union station in this city, which the Pennsylvania Railroad is building now, has been given to Carter & Fullman, a local firm of electrical contractors. The contract is said to amount to $50,000.

GREENVILLE, ILL.—The company operating under lease the city electric light plant has announced that commencing Jan. 1 the price of inside lights will be raised. The business men and citizens have signed an agreement to withdraw their patronage if this action is taken.

PITTSBURG, PA.—The J. C. Risher Coal Company, of this city, has installed an electric mining plant at its mines in Dravosburg, Hays and Shireoaks, by which the company expects to increase the output of the mines to a considerable extent. The plant includes a 50-kw generator and six mining machines.

BRANDON, MANITOBA.—The Electric Light Company is now building a power dam on the Little Saskatchewan river, about ten miles from Brandon. About 800 horse-power can there be developed, and this can be increased later. Dynamos are to be put in next spring, when both power and light will be furnished.

SHARPSVILLE, PA.—The Sharpsville Electric Light Company has commenced supplying the village with street illumination. Twenty-seven arc lights were turned on last week. The new company is one of the properties absorbed by the Penhale-Devitt syndicate, which has its headuarters in Youngstown.

CLEVELAND, OHIO.—G. W. Kinney will erect a large apartment house here, for which a lighting plant will be required. Knox & Elliott are the architects. M. A. Bradley, of Cleveland, is preparing plans for the erection of a large office building and power block, for which considerable electrical equipment will be required.

INDIANAPOLIS, IND.—Christmas street decorations and sidewalk illumination are taking elaborate form in this city. The scheme is general and not individual. The contractors are putting up a line of colored electric lamps following the curb, festoons of lamps cross the streets at intersections and the effectiveness of the display is beautiful and imposing.

SPRINGFIELD, OHIO.—E. S. Kelly has been granted a franchise for commercial lighting and steam heating in the business portion of the city. Mr. Kelly has made a bid for the municipal lighting contract, and in case the contract is secured a new company will be organized with the Kelly plant as a basis. In this event it will be necessary to enlarge the plant.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company has reduced its rates on the basis of the customer's maximum demand. The old rate of twenty cents per kilowatt-hour was equivalent to one cent per sixteen-candle-power lamp. Under the new rate of ten cents per hour after the first hour, the charge for the first hour being the old rate, the rate per lamp will be one-half cent per hour.

SAN FRANCISCO, CALIF.—The linemen's strike in this city is still on, but there is no excitement or violence. The Independent Electric Light & Power Company's linemen have returned to work, as that company has recognized the union and granted the wages requested. The electric companies in Sacramento, Calif., have also acceded to the men's demands, with the exception of the Sunset Telephone Company.

OMAHA, NEB.—The city engineer and electrician of Omaha have just completed a voluminous report upon the conduit system contemplated. The report shows that it would cost about $300,000 to prepare conduits to accommodate all wires carrying high potential currents and telegraph wires, and that, owing to the fact that the city is bonded to so near its limit, that it would be inadvisable for it to undertake the work at present.

SHEBOYGAN, WIS.—This city may purchase the electric lighting plant. Mr. George B. Mattoon, president of the Sheboygan Electric Light, Power & Railway Company, has given the city an option on his stock, which is 829 shares out of 1411. The city is offered these 829 shares at $25,000, the city assuming all outstanding obligations against the company. This option is held open until Jan. 10, 1901, and the proposition seems to meet with general approval.

HAMILTON, ONT.—The Nickel-Copper Company, of Ontario, whose large refining works are in this city, has begun operations on a large scale, and has placed in its new power house two 240-kw and one 75-kw, S. K. C., generators—the former to drive the dynamos for the electrolytic process, and the latter to drive the ore process. These three machines are being used as synchronous motors, taking the current from the Cataract Power Company's lines at 2,400 volts.

SEATTLE, WASH.—The Seattle Electric Company is making active preparations for the construction and equipment of a modern central power station in Seattle, Wash., the estimated cost being over $750,000. Charles C. Moore & Company, of San Francisco, as agents, closed the contracts for the main engine and for some additional boilers. The engine, which is a 4000-hp twin-vertical tandem compound of McIntosh & Seymour manufacture, is now en route to Seattle. It is said to be the largest stationary engine west of Chicago.

OTTAWA, ONT.—Shipment was made recently of the largest motor that has yet been built in Canada. The motor was consigned to the British America Corporation of Rossland, B. C., and the shipment was made by the Royal Electric Company, of Montreal, Que. The motor is an S. K. C., two-phase machine, and its capacity is over 1,000 horse-power. It is to be used to drive the compressors and hoists at the mines. The total weight of the motor, boxed, ready for shipment, was 105,000 pounds, or 52½ tons. The weight complete of the motor, with its accessories, was over 120,000 pounds, or 60 tons, requiring two cars to transport it across the continent.

THE ELECTRIC RAILWAY.

ROME, GA.—It is stated that the Rome Electric Street Railway Company is considering an extension of its line.

DECATUR, IND.—An application is pending before the City Council for an electric railway between Fort Wayne and Richmond.

BRIDGEPORT, MICH.—The County Commissioners have granted a franchise to the Saginaw Suburban Electric Railway.

RICHMOND, VA.—The Richmond Passenger & Power Company has begun the work of changing its Hollywood branch to an electric system.

ATLANTA, GA.—The Atlanta (Ga.) Railway & Power Company may construct a track out to Marietta. Application for this privilege has been made.

NEW YORK, N. Y.—The Ridgewood power house of the Brooklyn Rapid Transit Company in Wyckoff Avenue, was burned a few days ago, with a loss of $150,000.

ALTON, ILL.—The Alton Railway, Gas & Electric Company has purchased the property of the Alton Electric & Service Company, and the two companies are merged into one.

TOLEDO, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company is promoting a project for a central freight and passenger station to be used by all interurban roads entering the city.

KALAMAZOO, MICH.—The Michigan Traction Company is surveying a route for a direct road across the State from Detroit to St. Joe to connect with the steamboat line to Chicago.

CALDWELL, OHIO.—There is an opening here for an electric railway enterprise. A road to adjacent towns would be a great convenience, and there would be no competition in any direction.

NILES, MICH.—Vice-President Smith, of the Indiana Electric Railway Company has applied to the local Council for a franchise for a road through this place, to extend from South Bend, Ind.

KINGSTON, ONT.—Mr. J. A. Shibley, of Napanee, Ont., has made an offer for the purchase of the street railway system of the city of Kingston, which is likely to be accepted by the present owners.

PITTSBURG, PA.—The Monongahela Traction Company has purchased the McKeesport, Duquesne & Wilmerding and the Mon-Yough Street Railway companies' lines. The consideration is $600,000.

COVINGTON, KY.—The plant of the Suburban Electric Company was purchased a few days ago by the Burdette-Loomis Company, of New York City. A twenty-years' franchise will be granted the company.

MARTINSVILLE, IND.—The Commissioners of Morgan County have extended the franchise of the Indianapolis & Martinsville Traction Company to Sept. 1, 1901, and the Council of the town of Mooresville did likewise.

STEUBENVILLE, OHIO.—The directors of the Steubenville, Mingo & Ohio Valley Traction Company have decided on an extension from Mingo south to Brilliant. They are also planning a northern extension to Toronto.

ALLEGAN, MICH.—The City Council has granted a 30-year franchise to the Grand Rapids, Allegan & Kalamazoo Traction Company. The power house and car barns will be located here. Theodore Williams is constructing engineer.

YOUNGSTOWN, OHIO.—The Youngstown-Sharon Railway & Light Company has been incorporated in New Jersey. Capital, $2,500,000. Incorporators: Abram M. Hyatt, Harlan W. Whipple and Leighton Calkins, all of Jersey City.

GREENCASTLE, IND.—The County Commissioners have granted a franchise to W. B. Vestal and others to operate electric railways on the principal thoroughfares in Putnam County. It is the purpose to build the east and west line at once.

STEUBENVILLE, OHIO.—Eastern capitalists are negotiating for the purchase of the Steubenville Gas & Electric Light Company's plant and the Steubenville Traction Company's road. It is proposed to extend the street railway line.

CHICAGO, ILL.—Emil A. Basener has filed a bill in the Circuit Court, setting out the liabilities and assets of the Chicago General Railway Company and asking the appointment of a receiver to collect the assets and pay the debts of the company.

TOLEDO, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company will place on the market within a few days an issue of $1,500,000 in bonds. It is said that the entire issue has been practically taken by Spitzer & Company, local brokers.

CINCINNATI, OHIO.—A franchise has been granted to James B. Swing and L. C. Black to construct an electric railway connecting the towns of Franklin, Springboro, Red Lion, Deerfield, Kings Mills and Mason with the county seat of Warren County.

KNOXVILLE, TENN.—Mrs. Mary J. McCampbell, a minority stockholder of the Fountain Head Street Railroad Company, has secured the appointment of a temporary receiver for the Fountain Head Railroad Company and the Fountain City Land Company.

MARIETTA, OHIO.—The City Council will be asked for the right of way for a new electric railway. The proposed route will connect Parkersburg and Williamstown and Marietta and Beverly. The line will extend up the Muskingum as far as Devols Dam.

WAUSAU, WIS.—A project of an electric railway between this city and Merrill is being discussed and is looked upon with much favor. The plan is to utilize the water powers at each city and to dispose of the surplus power for lighting purposes and to operate machinery.

AKRON, OHIO.—Thomas F. Walsh, who recently sold out his interests in the Akron & Cuyahoga Falls Rapid Transit Company to Eastern capitalists, states that the new owners propose to extend the Kent line on to Ravenna, Warren, Youngstown and eventually to Pittsburg.

HOT SPRINGS, ARK.—It is understood that S. W. Fordyce and Charles McKee, of St. Louis, owners of the electric street railway system, have purchased the Hot Springs Water Works, gas, electric light and power plants from Col. John Martin, of Minneapolis, Minn.

KOKOMO, IND.—The Central Traction Company has awarded the contract for the construction of the electric railway between this city and Indianapolis. The entire length of the line is 65 miles. The construction work was let to a Chicago firm and the consideration is over $1,000,000.

CINCINNATI, OHIO.—The County Commissioners of Belmont County, Ohio, have granted a franchise for a street railway along the National Road through that county. A rental of $25 per mile per annum is to be paid for the use of the highway after five years and $50 a mile after ten years.

SHELBYVILLE, IND.—This city will have two interurban electric railways to Indianapolis within the next year. The surveys of both lines are now completed and work of construction will begin soon. The promoters will close all contracts within a few weeks. Each of these lines will be about 26 miles long.

INDIANAPOLIS, IND.—The Indianapolis & Northwestern Railway Company has petitioned for a franchise to build an electric road between Crawfordsville and Indianapolis. The petitioners are Frederick M. Ayers, Wm. N. Taylor and John H. Carson. Arrangements are being made to carry express and freight.

CLEVELAND, OHIO.—The Eastern people who recently bought out the Akron & Cuyahoga Falls Rapid Transit Company's lines have completed plans for large extensions to both the Akron and Barberton power houses. Bids have been asked for on two 500-kw railway generators and on proportionately large engines and boilers.

PAINESVILLE, OHIO.—P. B. Foster, of Cleveland, and associates have applied to the Village Council for a franchise for an electric railway to Fairport Harbor, three miles north. They have also made a proposal to buy the municipal lighting plant at its appraised value and to operate it for less than the village now pays.

CINCINNATI, OHIO.—A syndicate, headed by prominent citizens of Cincinnati, is securing consent of property owners along certain streets for the construction of an electric railway. It is understood this syndicate hopes to reach Brighton in the West End and connect from the central part of the city with the Westwood tracks.

SHERMAN, CALIF.—The Los Angeles Pacific Railway Company's electric power station at this place was recently the scene of a disastrous boiler explosion, which destroyed the boiler house and damaged the engine room. Two men were injured and the damage will run well into the thousands. Three months previously a boiler exploded in the same plant.

YOUNGSTOWN, OHIO.—Plans have been prepared for an extensive addition to the power house of the Youngstown & Sharon Electric Railway in this city, which will furnish both power for the road and city lighting. A contract has been closed with the Babcock & Wilcox Company for a battery of boilers and other contracts will be closed within a few days.

CLEVELAND, OHIO.—Luther Allen, of this city, president of the Toledo & Western Electric Railway Company, is authority for the statement that the road will be extended at once to the Indiana State line, and that it will eventually be extended to Chicago. The road has been completed almost to Sylvania, and it will be placed in operation to that point in the near future.

RICHMOND, IND.—Engineers are now at work on a second survey of the proposed electric railway from Eaton to this city. The franchise granted over the roads in this county and Preble County, Ohio, to W. Pruden and associates of Dayton is to be transferred to the Dayton & Western Traction Company, which owns and operates the line between Dayton and Eaton.

COLUMBUS, OHIO.—A new company has been incorporated under the laws of New Jersey, with $400,000 capital stock, to build a road from Columbus to Delaware, passing through Dublin, Plain City and Marysville. Franchises have been secured from the Commissioners of Delaware and Union counties. T. N. Kerr, of Columbus, is the promoter and capital has been subscribed in the East.

CLEVELAND, OHIO.—The consolidation of five street railways entering Wheeling, W. Va., and the Wheeling & Citizens' Railway companies has been effected under the name of the Wheeling Traction Company. The incorporators were: A. R. Manning, Henry Ford, A. M. Synder and L. M. Hildreth, all of Cleveland. T. B. Conderman, of Philadelphia, is president of the new company.

MEDINA, OHIO.—The Medina County Commissioners have granted a franchise to the Cleveland, Elyria & Western Electric Railway Company, completing its right of way for a branch line from Cleveland and Berea to Strongsville and Medina. The company has filed a mortgage given to the Western Reserve Trust Company, of Cleveland, to secure payment of $1,500,000 in 20-year 5 per cent bonds.

HONOLULU, H. I.—The Honolulu Rapid Transit & Land Company, which is building a 20-mile electric railroad, has ordered through Charles C. Moore & Company, San Francisco, the engine and boiler plant for the new system. There will be a tandem compound Hamilton-Corliss engine and Babcock & Wilcox boilers of sufficient capacity to operate three 300-kw generators. The plant is now in course of erection.

CONCORD, N. H.—The following new street railway companies have been recently incorporated: Portsmouth, Exeter and Newmarket Street Railway, with $100,000 capital stock; the Portsmouth, Great Bay & Dover Street Railway, with $75,000 capital stock; the Haverhill & Newton Street Railway, capital stock, $40,000. Wallace D. Lovell, Newton, Mass.; Rufus N. Elwell, Exeter, and Warren Brown, Hampton Falls, are incorporators of all three companies.

TERRE HAUTE, IND.—The Board of Public Works has made known the terms on which it will give the Wabash Valley Electric Company a franchise. It provides for a deposit of $24,000 in cash by the company. Four roads are to be built, and as fast as a line is completed the company is to have $3,000 refunded, and the city is to retain $12,000 for its remuneration. A majority of property owners in a street must give permission for the laying of tracks in that street.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has approved the recommendation of Mr. John I. Beggs for the extension of its lines and the enlargement of its power house. The erection of a central car house and general office building and other extensive improvements of the company's property and facilities form part of the general plan. The cost of these improvements will be approximately $2,000,000 a year for the next five years. Additional stock will be issued to raise the money.

PITTSBURG, PA.—The new trolley line of the United Traction Company of this city, between McKeesport and Wilmerding, has begun operations. This is said to be one of the most expensive pieces of electric railroad in this country. The line is only three miles long, but it cost $300,000. This enormous cost of construction was caused by the fact that the line passes through a great many private properties, and that in other parts it had to be built through stretches of rock.

NEW HAVEN, CONN.—The Fair Haven & Westville Street Railway Company, which owns or controls the whole local trolley system, has given legal notice of applications to the State Legislature for very important extensions. They include new lines to Derby, Wallingford, Cheshire and Milford, from Wallingford to Mount Carmel, and a large number of extensions through streets of this city and West Haven. The Wallingford, Derby and Cheshire extensions parallel the tracks of the New Haven steam railroad company, and the new rights asked for cover additional trackage of probably not less than forty miles.

NEW YORK CITY.—The Metropolitan Street Railway Company has stopped all construction work for the winter, which is already very severe. Mr. Vreeland says that next summer is to be one of the busiest in the history of the company, and he hopes to see the completion of all the important plans he has in view for the perfection of the Metropolitan system. The most important of these will be, of course, the changing of the motive power of the Broadway, Columbus avenue and Lexington avenue cable lines to electricity. The change is to be made as soon as the frost is out of the ground and all danger of snowstorms is over. The change of motive power will bring with it several important changes in the service.

NEWARK, N. J.—The trolley lines in Elizabeth, Rahway and Plainfield, with the exception of the North Jersey Street Railway Company's system in Elizabeth, have been consolidated, and will be known as the Elizabeth, Plainfield & Central Jersey Railway. The new company has a capital stock of $3,000,000, and is authorized to issue bonds to the amount of $2,500,000. The lines consolidated include about 60 miles of track. Extensions of the system are contemplated. David Young, vice-president and general manager of the North Jersey Street Railway Company, is president of the new corporation, and other officers are Thomas A. Nevins, of Orange, vice-president; State Senator Thomas N. McCarter, of Newark, treasurer, and Col. Edwin W. Hine, of Orange, secretary. The companies consolidated are the Westfield & Elizabeth Street Railway Company, the Elizabeth City Horse Railroad Company, the Elizabeth Street Railway Company, the Plainfield Street Railway Company and the Rahway Street Railroad Company. The lines extend, with branches, to Dunellen, Westfield, Rahway, Boynton Beach, Plainfield, Roselle, Scotch Plains and North Plainfield. Both of the Elizabeth companies were owned by Senator John Kean, whose interests are bought outright by the new corporation. Of the $2,500,000 bond issue $1,500,000 will apply to the purchase of the Kean interests and those of the Rahway Company. The rest will be spent in improvements and extensions to the system.

THE AUTOMOBILE.

PHILADELPHIA.—Local capitalists will shortly ask the Philadelphia Council for an automobile 'bus franchise for Broad Street.

NEWPORT, R. I.—The Automobile Company has been granted a license for conducting a parcel delivery service about the city for the delivery of Christmas packages.

AUTOMOBILES IN GOLDEN GATE PARK.—The San Francisco Park Commissioners recently came to a final decision as to the admission of automobiles to Golden Gate Park. Only electric vehicles will have the privilege, and they are required, for the present, to enter the park at the Waller Street entrance and to confine their route to the South Drive, as far as the southwest corner of the park.

LEGAL.

DIEHL MANUFACTURING COMPANY'S CEILING FAN PATENTS.—A decree was entered on Dec. 5 in the United States Circuit Court for the Eastern District of Pennsylvania in a recent action of the Diehl Manufacturing Company against the Marietta Manufacturing Company and H. Burd Cassel, receiver, for infringement of United States patents relating to electric ceiling fans—No. 465,360, of Dec. 15, 1891; No. 465,361, of Dec. 15, 1891; No. 537,679, of April 15, 1895; No. 585,250, of June 29, 1897. This decree declares these patents to be valid and to have been infringed by the Marietta Company, and orders "that a perpetual injunction be issued in this suit against the use of these inventions by the defendants."

PERSONAL.

MR. J. JACOBS, of the Triumph Electric Company, Cincinnati, has returned home from a three weeks' trip through the East.

MR. C. W. WOODWARD has been appointed purchasing agent of the Electric Storage Battery Company, to succeed the late Mr. John B. Faulkner, Jr.

DR. THOMAS ADDISON, the General Electric Company's Pacific Coast representative, recently left San Francisco for a month's visit in New York.

MR. G. WESTINGHOUSE.—It is learned that Mr. George Westinghouse has bought the entire Buenavista grant of 7000 acres in Arizona, and intends to erect on the Santa Cruz River colossal copper reduction works and smelter, and build a railway connecting the mines, the reduction works and Nogales.

MR. F. E. DRAKE, director of machinery and electricity for the United States at the Paris Exposition, has returned to this country on a flying trip and will attend to various matters here during his short stay. He will sail again shortly for Europe and will visit Germany.

MR. V. H. YARNALL has been appointed Eastern manager by John T. McRoy, the well-known underground conduit manufacturer. His territory will also include Canada. Mr. Yarnall has been active in the electrical field since 1882, beginning with the old Brush interests in Philadelphia, and his work covers the whole field of development in light and power, his latest connection being with the Sprague Elevator Company. Mr. Yarnall is widely acquainted also in technical circles, and is a member of the American Institute of Electrical Engineers.

EDUCATIONAL.

WISCONSIN UNIVERSITY.—A number of engineering course students from the Wisconsin University will soon visit Oshkosh, Wis., to inspect and look over the lines and plant of the Winnebago Traction Company, with a view of becoming conversant with street railway work.

FRANKLIN INSTITUTE.—The Board of Managers of the Franklin Institute, Philadelphia, Pa., on the evening of Dec. 8 gave a reception to members and friends at the Institute buildings. The programme included music, exhibition of photographs, and an exhibition of special apparatus.

ARMOUR INSTITUTE.—We are in receipt of a copy of the year book for 1900-1901 of the Armour Institute of Technology, Chicago, Ill., which gives outlines of the courses in the various branches taught at this well-known institution; also a list of the names of the alumni and much other information on the general subject.

Trade Notes.

INCREASE OF CAPITAL.—The Western Electrical Supply Company, St. Louis, Mo., has increased its capital stock from $25,000 to $100,000. The assets are $326,578.61, and liabilities $176,082.69.

THE ELECTRICAL WIRE SUBWAY COMPANY has been incorporated at Kansas City, Mo., with a capital of $200,000. The incorporators are William Huttig, W. S. Woods, Joseph J. Heim and others.

THE DEVERE ELECTRIC COMPANY, Cincinnati, O., has just installed in the steamboat "Florence Marmet" a complete electric light plant. This is said to be the finest installation of this character on the Ohio River.

THE STURTEVANT ENGINE.—The B. F. Sturtevant Company, Boston, Mass., in a pamphlet describes and illustrates the Sturtevant engines for electric light plants and general high-grade work. Diagrams and dimensions of the principal types of engine are given.

MACHINE TOOLS.—Mr. Zortman, of the Brown-Zortman Machinery Company, of Pittsburg, spent several days in Cincinnati recently figuring with manufacturers of machine tools in the interests of the Westinghouse Electric Company for its new plant in England.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is extremely proud of the fact that its Packard lamps were adopted by the Government to light the Paris Exposition. It states that they are being adopted by a greater number of users in both the local and foreign markets than ever before in their history.

MESSRS. SIPE & SIGLER, Cleveland, manufacturers of the Willard storage battery, are installing a storage battery plant of 600-ampere-hours' capacity in the new Rose Building, in that city. It will be used for overloads and in operating lights and elevators at night. The Western Electric Company is supplying a booster.

"FALCON" PANEL BOARDS.—The Falcon Electric Manufacturing Company, New York, has issued a supplement to its Bulletin No. 4 on the subject of "Falcon" Panel Boards. The supplement gives a price list for additions to panel boards Nos. 212, 213, 222 and 223; also some facts regarding the construction of the same.

THE H. C. ROBERTS ELECTRICAL SUPPLY COMPANY, 831 Arch Street, Philadelphia, has just issued its monthly calendar, bearing a very pretty picture in colors and wishing a Merry Christmas to all. Accompanying this calendar is an attractive little folder describing O. K. weatherproof wire; also a circular describing A B arc lamps.

THE UNITED ELECTRIC, GAS & POWER COMPANY, Santa Barbara, Calif., which is to install a 300-kw direct-connected General Electric generator in its new plant, recently closed contracts with Charles C. Moore & Company, San Francisco, for a McIntosh & Seymour cross-compound engine and Babcock & Wilcox boilers to operate the same.

METAL GOODS.—The Bliss-Chester Company, Providence, R. I., has sent out a calendar for the new year. The company calls attention to the fact that it manufactures brass and metal goods, incandescent lamp bases and screw machine products. Its goods are largely used by the electrical trade. The illustration on the calendar is entitled "Nature's Electric Light."

KENTUCKY ELECTRIC COMPANY.—One of the earliest calendars for the new century has been received from the Kentucky Electric Company, Owensboro, Ky., which manufactures the "Kentucky" incandescent lamps, motors and dynamos. The illustration is that of a young girl crowned with a wreath of lilacs. The coloring is tastefully done, and the calendar presents a very attractive appearance.

MR. J. J. REIDY, New Haven, Conn., maker of the Donnelly improved steel climbers, reports that the following concerns have put in a stock of his goods and can furnish any quantity desired either from stock or at short notice: Smith Electrical Engineering Company, Watertown, N. Y.; Walbridge & Company, Buffalo, N. Y.; Roe & Conover, Newark, N. J.; Doubleday-Hill Electric Company, Pittsburg, Pa.; McIntosh-Huntington Company, Cleveland, Ohio; Morley Bros., Saginaw, Mich.

CARBON PRICES have never, as a rule, been advertised broadcast, although prices are mentioned as a matter of news from time to time in these columns. The United States Carbon Company, of Cleveland, Ohio, has entered upon a campaign for business, one of the features of which will be a public quotation of the prices of their carbons. This departure from the usual method of doing such business will be watched with much interest. It will mean, for one thing, that there can be no "trades" and "dickers" in buying U. S. carbons.

THE JELLY STORAGE BATTERY.—The Jelly Electrolyte Battery Company, Boston, Mass., has for several weeks been testing in automobile work a storage battery with an electrolyte of jelly-like substance. It is claimed that the spilling of the electrolyte is entirely obviated in this battery. Other advantages claimed for the jelly electrolyte are that the evaporation is reduced to a minimum and that it tends to hold the active material to the element, thus preventing disintegration and reducing the danger of short circuiting within the cell.

MICA BOND.—The Chicago Mica Company is sending out a circular to the trade for the purpose of correcting some erroneous statements that have been set afloat concerning it to the effect that it has been absorbed and gone out of business. The company states that it is still in business, and is the sole owner and occupant of the largest factory in the world exclusively devoted to the manufacture of mica insulation. It has just completed additional buildings to increase its manufacturing facilities and the production of its goods. It is better prepared now than ever to fill orders for its different grades of mica bond, India and amber mica.

THE LUNKENHEIMER COMPANY, Cincinnati, Ohio, celebrated the opening of its new branch factory by a reception and dance, which was attended by about one thousand people. This factory was described in these columns in issue of Dec. 1. The officers of the company are: E. H. Lunken, president; D. T. Williams, vice-president; C. F. Lunkenheimer, treasurer; S. L. Moyer, secretary; William Muench, auditor. For several years the business has increased so rapidly that the present quarters are outgrown, and, as it is not possible to obtain sufficient adjoining property to take care of the growing business, the present branch factory was built. It is the intention to add two more buildings of about the same capacity each as the present one, as well as a large foundry 100 x 180 ft., in the early spring, and when completed these works will, it is said, be the most extensive and finest in this line of business in the country. The company's goods are shipped to all parts of this country, and are also used extensively in foreign countries, especially England, Germany, Russia and Australia. Its exhibit at the Paris Exposition this year was awarded the three silver medals.

CEDAR POLES AND TIES.—The Northern cedar yards of W. C. Sterling & Son, with headquarters at Monroe Mich., are very active, and train-loads of their stock are being shipped every day to points in Ohio, Indiana, Illinois, Pennsylvania, New York, Michigan and New Jersey. This firm has been very busy during the last three months filling their contracts and orders for cedar poles, ties and fence posts. They started in business twenty-one years ago, and have gradually built up a trade that requires shipments to all parts of the United States. During the last month they have shipped poles, ties and posts to 38 telephone companies, 18 electric light companies, 27 street railway companies, 6 pipe line companies and 2 telegraph companies. They look for a larger volume of business during next year, and expect prices to be very good. The lower price of steel rails and wire will increase the demand for cedar, as it will allow many railroad companies to do repair work and a lot of new building which such companies have delayed doing owing largely to the price of iron. The cost of getting out cedar and buying will be more this winter, and the weather will probably not be as favorable as it was last winter. This will lessen the output, and, the demand being larger, will stimulate prices. Cedar ties are now being used by most of the steam roads even on their main lines. Oak is getting high in price and scarce, and cedar is taking its place. Cedar poles are in big demand, and every length and size is selling at good prices. Chestnut poles are the nearest competition, but are not used by the large companies when they can get cedar at even higher prices. Cedar lasts longer, is better looking, the poles are easier to handle because of their lightness, and much easier to work on, as chestnut is a hard wood, and the spurs do not hold in it.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED DEC. 11, 1900.
[Conducted by Wm. A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

663,412. TELEPHONE SYSTEM; W. W. Bennett, Mesquite, Texas. App. filed Feb. 2, 1900. The connections are such that a subscriber can converse with a second subscriber on either side of his own instrument, the talking circuit being grounded at the time so as to cut out the line on that side of the instrument which is not in use.

663,419. THERMOSTAT; H. Cortland, Pittsburg, Pa. App. filed Jan. 13, 1900. Details of construction.

663,420. ARC LIGHT HANGER; G. Cutter, Chicago, Ill. App. filed March 10, 1900. The hanger is provided with a switch so constructed that when the lamp is supported by it the switch is held closed to supply current to the lamp; detaching the lamp breaks the circuit.

663,454. ELECTRIC ARC LAMP; F. W. Martin and F. Stewart, Hamilton, Canada. App. filed May 12, 1900. The magnet is supported between spring clamps so as to be readily removable for the substitution of other magnets of different resistance.

663,460. TELEGRAPH REPEATER; C. D. Olsen and T. W. Carroll, Denver, Colo. App. filed Aug. 17, 1899. One of the objects is to control the main line cut-out lever by the second lever acting directly thereon without intermediate instruments or magnets which cause delay before proper action can be had.

663,461. MAXIMUM-DEMAND METER; E. Oxley, Lynn, Mass. App. filed July 31, 1899. (See Current News and Notes.)

663,467. PROCESS OF PRODUCING ELECTRIC-ARC LIGHTS; E. Rasch, Nuremburg, Germany. App. filed May 7, 1900. (See Current News and Notes.)

663,489. ELECTRICAL CONNECTION; W. B. Cleveland, Cleveland, Ohio. App. filed Feb. 7, 1900. Two conductors, one incorporated in the other in varying degrees of intimacy, and forming at one portion a homogeneous structure with the other.

663,490. METHOD OF FORMING ELECTRICAL CONNECTIONS; W. B. Cleveland, Cleveland, Ohio. App. filed July 12, 1900. A modification of the preceding.

663,491. CONTROLLER FOR ELECTRIC MOTORS; C. A. Dresser, Chicago, Ill. App. filed May 10, 1900. The core of a controlling solenoid is made hollow and utilized as a governing dash-pot.

663,496. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed Feb. 11, 1899. The clips of a knife-switch consist of a U-shaped metal strip, the bend of which passes through a hole in the base and is then bent laterally to engage with a securing post at the back.

663,510. TELEPHONE SWITCHBOARD; W. S. Paca, Erie, Pa. App. filed Feb. 16, 1900. Details.

663,511. TELEPHONE SWITCHBOARD APPARATUS; W. S. Paca, Erie, Pa. App. filed Feb. 16, 1900. Details.

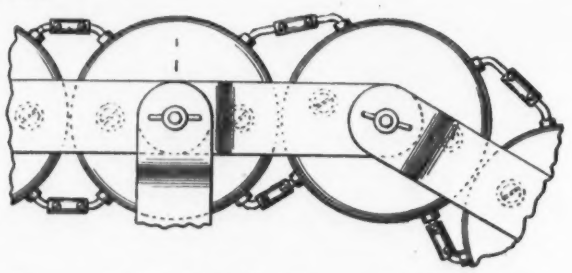
663,519. ELECTRIC RAIL BRAKE; Rudolf Willy Max Schiemann, of Dresden, Germany. App. filed May 22, 1899. The magnetizing spools and brake shoes are separate pieces. The multiple spools and shoes are alternately mounted on a spindle parallel with the track. The end shoe carries an anti-friction roller, which will strike the tread of the car wheel when the magnets are set in action, and thus take up the horizontal pull or thrust of the car engendered by the braking of the latter.

663,524. INCANDESCENT LAMP; S. D. Washburn, Boston, and C. H. Tinkham, Cambridge, Mass. App. filed March 12, 1900. A reflector is placed below the filament and diametrically across the bulb.

663,532. FLEXIBLE SUPPORTING STRUCTURE FOR ELECTRIC LAMPS; W. F. Brewster, New York, N. Y. App. filed June 12, 1900. This structure is used for electric signs and consists of a number of lamp receptacles mounted on hinged links so that their relative position may be shifted.

663,572. SUBSTITUTE FOR GUTTA-PERCHA; S. Heimann, New York, N. Y. App. filed Feb. 8, 1900. (See Current News and Notes.)

663,600. ELECTRIC RAILWAY; T. P. Chandler, Philadelphia, Pa. App. filed Oct. 22, 1900. The trolley wire is supported by horizontal brackets extending from vertical arms and each consisting of a strap embracing the wire.



663,532.—Flexible Supporting Structure for Electric Lamp.

663,605. WIRE COUPLING; W. Frankham, Canton, Ohio. App. filed May 24, 1900. The wires pass into each end of the coupling and enter an enlarged opening therein; the ends of the wires are then bent to form a head preventing their withdrawal.

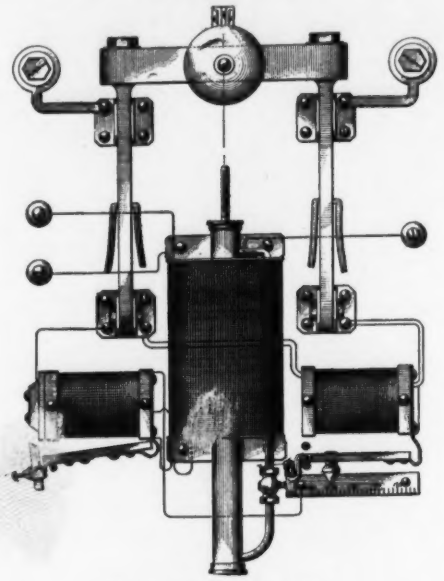
663,609. DYNAMO OR MOTOR; G. L. Martin, New York, N. Y. App. filed Aug. 24, 1900. A casing provided with poles, comprising a shell and an inserted core extending through the shell and forming part of the face of the pole.

663,612. CIRCUIT CHANGER; E. Oxley, Lynn, Mass. App. filed May 29, 1899. The circuit changer comprises circuit terminals, a liquid conductor connecting them and an insulating shell movable to surround one terminal and thus break the circuit.

663,625. SYSTEM OF ELECTRIC TRACTION; M. T. De Felice, Rome, Italy. App. filed June 9, 1900. Details of a magnetic arrangement for closing and opening the switches in the branches leading to the sections of the working conductor.

663,659. SYSTEM OF ELECTRICAL DISTRIBUTION; H. R. Kent, New York, N. Y. App. filed May 1, 1900. (See Current News and Notes.)

663,695. ELECTRICAL INTERRUPTER; J. M. Davidson, London, England. App. filed June 7, 1900. The interrupter comprises a tank containing mercury, a shaft carrying a disk at its end which contains the contacts, the shaft being inclined so as to pass over the edge of the tank without exposing the contact, which should be submerged in the mercury.



663,781.—Circuit Breaker.

663,698. ELECTRIC ARC LAMP; J. H. Hallberg, Peabody, Mass. App. filed July 16, 1898. Details relating to the various parts of the lamp.

663,700. OVERHEAD TROLLEY SYSTEM; C. L. Leiby, Knoxville, Tenn. App. filed Dec. 5, 1898. The metal supports for the trolley wires are formed with points to which the wires are welded, thereby producing a smooth joint and a continuous conductor.

663,719. ELECTROLYTIC APPARATUS; H. Becker, Paris, France. App. filed June 26, 1899. A collecting cone of metal is suspended in the electrolyte above the cathode, which collects the metals rising to the surface in the electrolysis of their salts in fusion.

663,740. TROLLEY FOR ELECTRIC CARS; W. H. Earl, Painesville, Ohio. App. filed Aug. 14, 1900. The harp is hinged to swing laterally and the wheel is carried in a frame having a vertical pivotal connection with the harp.

663,750. ELECTRIC CONTACT OR CURRENT TAKING DEVICE; E. Greil and E. Audiger, Paris, France. App. filed Jan. 10, 1900. A table upon which lamp and similar apparatus are to be placed is provided with grooves containing plates forming the terminals of the circuit with which certain plugs on the apparatus engage.

663,760. MAGNETIC ORE SEPARATOR; A. Johnson, Moline, Ill. App. filed Feb. 2, 1900. The ore is passed through a solenoid and is collected by a series of magnets arranged within the same.

663,764. MAGNETIC SEPARATOR; E. Kreuser and H. E. Langguth, Mechernich, Germany. App. filed June 11, 1900. An apparatus for separating substances of different magnetic susceptibility, consisting of two magnets arranged one above the other, the upper one comprising a rotable cylindrical magnet, and an inclined slide or chute having no magnetic susceptibility, the lowermost end of said slide or chute being projected between the magnets into the center of the magnetic field at the point of least distance between the magnetic surfaces.

663,767. FIRE ALARM; R. C. Livingston, Spring Valley, Minn. App. filed March 24, 1900. Details.

663,781. CIRCUIT BREAKER; G. W. Parsons, La Grange, Ill. App. filed April 6, 1900. A circuit breaker, comprising contact blades, a latch for holding said contact blades in circuit-closing position, a solenoid adapted to be operated by an overload of current in the main line, a core in said solenoid operating to release the holding latch, and electrically controlled means for regulating a lubricating and retarding liquid to said core.

663,783. SELECTIVE SIGNAL SYSTEM; F. A. Pickernell, Newark, N. J. App. filed Aug. 14, 1900. (See Current News and Notes.)

663,788. TROLLEY POLE; W. Schroeter and A. Kautzmann, Dallas Texas. App. filed June 11, 1900. The pole is equipped with a wire finder consisting of an arm which may be pulled into operative position by the rope, and when the wheel has been adjusted to the wire the slacking of the rope permits the finder to fall into a position where it will not interfere with the running of the wheel.